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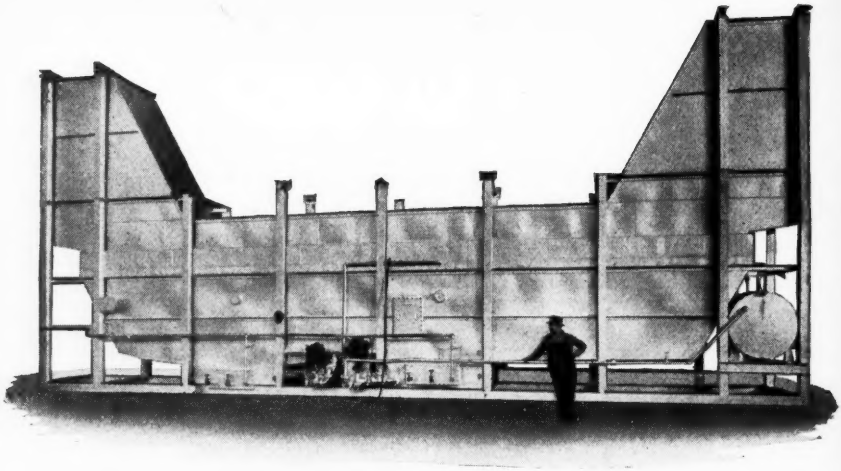

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Cincinnati, Ohio Vol. 1, No. 10

July, 1937

Outline of Interesting Enameling Problems

By Dr. J. E. Rosenberg

Director of Research, The O. Hommel Company

It seems to be in our natures to take for granted the common things with which we are in daily contact. In the twenties, we wondered at the marvels of the crystal set by which with the aid of earphones and some luck, we could hear sound transmitted through space. The children of this generation who see a completed radio in their home are not at all impressed with its wonders, even though it is a much more efficient and complicated instrument than its progenitor, and so it is with countless other things which surround us in our daily life. Of course, we take for granted the vegetation which covers most of our landscape and yet the processes by which they are created are more wonderful than television, skyscrapers, stratospheres, etc.

Porcelain enamel on steel while not one of the seven wonders of the world, is an accomplishment of which our ceramists can well be proud. It represents in one respect a combination which seems on the surface impossible. It combines the strength and cheapness of steel with the beauty and permanence of glass. Porcelain enamel is glass welded to steel. When one considers the difference in the nature of the two materials, the difference in their physical properties, it is surprising that it can be done at all, and more surprising that it can be done at such a low cost. Steel is ductile, glass is fragile. Steel has a high coefficient of thermal expansion, about twice that of glass, and steel has a high thermal conductivity, about a hundred times that of glass. When glass and steel are heated together, the glass melts at such a high temperature that it is practically impossible to keep the iron from scaling. There are many more practical difficulties than are here mentioned, but the fact that they have been overcome does not minimize the problems involved. In

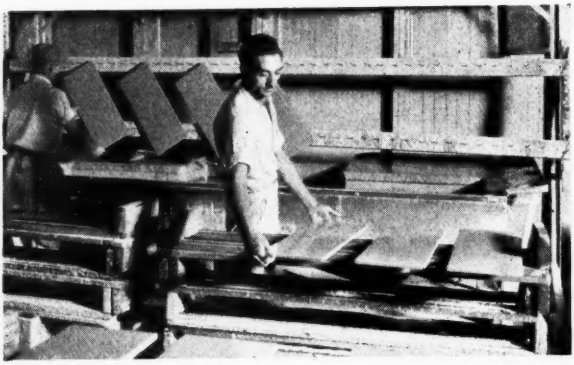

Fig. 1—After the workpieces have been thoroughly cleaned, they are dipped into a trough of ground coating material which consists primarily of a gray composition formed chiefly of glass and a slight amount of cobalt. The pieces are hung on racks and the excess ground coating allowed to drain off.

this brief discussion, I wish merely to outline the major problems of porcelain enameling on which our research laboratories have concentrated their efforts.

The Metal

The metals commonly enameled are the purest and most impure iron; (cast iron) used to some extent, is of relatively little importance when compared with a large volume of enameling on steel. Roughly, I would say that for the surface covered the ratio is about 10 to 1 in favor of the steel. Cast iron will not withstand a high firing temperature without warping, therefore the enamels that are used on it are low firing. Generally, cast iron is not fired much higher than about 1350, and the glasses used on it must mature at that temperature. In the past, the glasses used were entirely lead bearing in order to get this low-melting temperature. More recently there have been developed leadless enamels which mature at these temperatures. The cast iron must have a certain definite composition in order to be used for porcelain enameling.

The steel used is generally low metalloid composition. The highest grade of ware is from iron containing less than 0.1 per cent impurities. The carbon runs about .02, and the other impurities such as manganese sulphur, do not run much higher. In the kitchen ware industry where flat shapes are not used and parts have rigidity due to their shape, sheets are used which are higher in carbon and may go as high is .50 manganese and up to .05 phosphorous and sulphur. It is generally thought that low metalloid steel must be used in order to avoid the gases due to the carbon, but this is not the whole picture. The critical temperature of iron which is around 900 deg. C. is lowered by the addition of the metalloids commonly found in steel. As this point is approached, the metal will warp or sag during firing. Since enamel compositions which work best usually require a firing temperature of between 1550-1600 deg. for the ground coats, it is obvious that any lowering of the critical point would be undesirable. The steel after being shaped is prepared by cleaning to remove the grease, pickling to remove oxides or scale.

The Glass

Glass is the most important phase in the entire field of ceramics. It is to a glass or glaze which chinaware, tile, and sanitary ware owes it utility. Porcelain enamel is steel coated with glass. The smoothness of surface and imperviousness of the material as well as its chemical durability are the properties in glass which are de-

sirable. Even in bricks and refractories it is the glassy phase which acts for the bond of the material. Porcelain enamels are glasses of low-melting point. In the case of cast iron enamels as previously mentioned, they are fired at around 1350 deg., while steel enamels are fired between 1500-1600 degrees. Steel enamels in general owe their low melting point particularly to the high borax content. The important and common ingredients in all steel enamels are feldspar, silica and borax. Of these, 80 parts of the raw batch weight for ground coats the borax averages around 30, while for cover coats it is usually between 20-25. The other ingredients used are flouorspar, cryolite, soda ash and nitre. Ground coats have in addition to the usual glass-forming ingredients cobalt, nickel, and manganese oxides. The cobalt oxide is the most essential, as ground coats can be made without the addition of manganese and nickel, while they cannot be made without cobalt. The glasses are smelted from the finely powdered raw materials in an openhearth or rotary furnace, and when thoroughly melted, the molten glass is run into water to frit it or shatter it into small pieces. The glass is ground in a ball mill to reduce it to a paste of such consistency that it may be dipped or sprayed as desired. About 7 parts of clay and 40-50 parts of water are used with the 100 lbs. of glass. The enamel is applied to the ware by spraying or dipping and after drying, is fired in a box, or continuous furnace. For sheet irons, the period of firing is usually short and seldom exceeds 5 minutes for ordinary ware. In firing the ground coats, sufficient time must be given to fuse the enamel as well as to bond it to the steel. Cover coat enamels are applied in the same way and usually fired at a lower temperature than the ground coat. The ground coats are harder and require a higher fire to mature them.

The Bonding Problem

Any amateur who has attempted to solder a piece of iron knows how difficult it is to have the solder adhering firmly and smoothly to the metal. He knows that the metal must be thoroughly free of oxides or any foreign material. The metal must be sufficiently hot so that the solder will not solidify before it has a chance to wet the iron. The mechanism by which solder sticks to iron is perhaps slightly different from that involved in the joining of porcelain enamel and steel, but the general problem of making things stick together is involved. Adhesives in general are materials which wet the

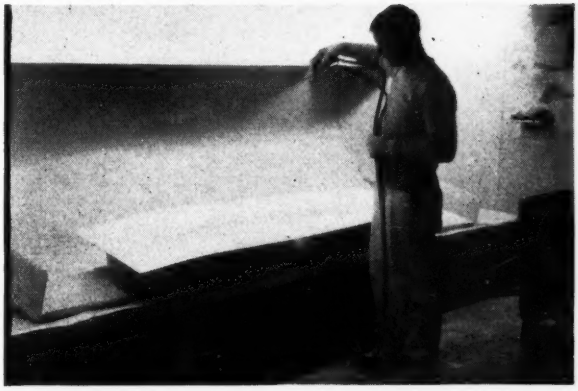

Fig. 2—As far as possible, all work that is to be enameled a given color is sprayed in the same booth; thus the booth in which the white enamel is sprayed is never used for any other color. Located at the rear of the booth shown in the illustration are exhaust fans which carry off all excess spray.

surfaces that are to be united, and after wetting either by drying or solidifying become solids and have sufficient strength to withstand any mechanical stress tending to part the combined pieces. The strength of the bond in this particular case is the strength of the solid adhesive, whether it be solder, glue, or any other plastic material. In the case of porcelain enamel, there is no adhesive used, but the glass itself covers the steel, melts, wets it, and then solidifies.

What is the Nature of the Bond?

Microphotographs of a cross section of enameled iron shows that the bond between the glass and the steel is mechanical and is due to an interlocking of the two materials. The glass in its molten state has penetrated into the iron and is held there mechanically. The greater contraction of the iron in cooling from firing temperature holds the glass better than would be the case if the two materials expanded at the same rate. Without a knowledge of the facts, one would assume that the iron surface must therefore be rough in order to get good bond. In this respect, it would appear to be similar to the application of paint to wood, in which case it is desired that the surface of the wood be roughened so that there will be some interlocking of the wood to paint. This is not the case however. An examination of the steel prior to enameling does not show the irregularities which are found in an enameled article. The glass itself acts as a reagent which digs its own foundation into the iron. The glass chemically reacts with the metal and takes the iron into solution. If this errosion were regular, the bonding would not take place. The glass must therefore be an etching agent which produces a rough rather than a smooth surface. The iron which goes into solution in the glass modifies considerably its composition and properties, so that we have between the body of the glass and the steel an interfacial layer having specific and different properties. In order to be suitable for this purpose, the glass must hold the iron in solution and must be of such a nature that the etching produced will be rough. It seems to the writer that this nonuniform etching has been overlooked. There is another possible and plausible explanation of the same phenomena which has been advanced. This is that the bonding layer is iron oxide. The steel when first placed in the furnace forms on its surface a layer of iron oxide. At the temperature of the furnace the layer is usually magnetic oxide of iron. This layer is firmly adherent to the steel and only cracks off when it is taken from the furnace due to the differential expansion of the two sub-

Fig. 3—Where the required number of base coats have been applied, and a design in a different color is desired, a stencil must be used. The colored enamel for the "overlay" is sprayed on. When this coat dries it becomes powdery and can easily be brushed off. A stencil of the desired pattern is carefully placed over the work and the openings in the stencil are brushed out.

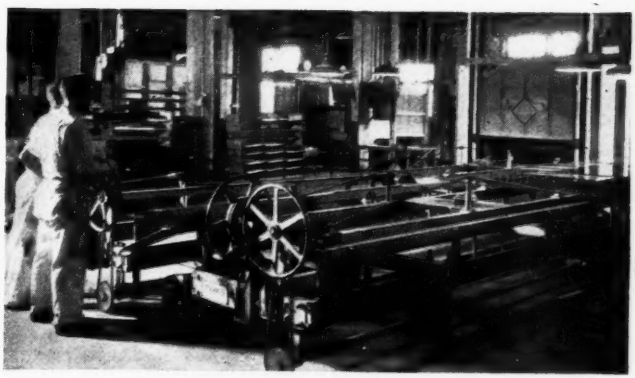

Fig. 4 — Following each application, the enamel coating is made integral with the previous coating by "fusing" it in a furnace. The furnace shown in the illustration is electrically heated and controlled and is equipped with a twin loading mechanism which saves time and increases production.

stances. This is particularly true when the scale is thick. The iron oxide layer on cooling decomposes to give metallic iron and ferric oxide which goes into solution in the glass. Perhaps it is this metallic iron which forms an intermittent screen which makes the etching or the errosion non-uniform. This explanation, however, does not account for the need of cobalt oxide. Cobalt oxide is the "catalyst" necessary for the bonding of glass to steel. Glasses which do not contain a small amount of cobalt oxide will not adhere to the steel. The discovery of this philosopher's stone was probably pure accident, because after a half century of use, a well substantiated explanation for its use has not been established. In general, ground coats are high in borax, and this no doubt is necessary in order to obtain the high solubility of the glass for iron oxide.

It has been suggested and there is some data to substantiate it that adhesion between the steel and the glass is made possible in spite of the difference in their coefficient of expansion, because the interfacial layer is high in iron oxide and therefore has a coefficient of expansion approaching that of iron. As the distance from the iron surface is increased, the percentage of iron oxide decreases so that there is a gradual rather than a sudden change in the expansion of the glass from the interfacial layer to its surface. In the case of the enameling of other metals, such as copper, platinum, and gold, the glasses seem to adhere readily to these materials even without the addition of cobalt, and cobalt seems to be unnecessary. The bond in these cases seems to be purely adhesion between the glass and the metal, as the metal is wet by the glass. In this case the phenomena is not complicated by the formation of a metallic scale which must be dissolved by the iron.

White Ground Coats

The first enamels used on iron were these blue cobalt glasses. In this case the color of the cobalt was a desirable rather than an undesirable feature. With the expansion of enameling, various colors were desired, and therefore enamels were mixed with almost every color in the spectrum as well as white and black and applied on the ground coated steel. Since the ground coat in this case serves no other purpose than as a foundation layer for the other coats of enamel, there has been an attempt for years to eliminate it. Since the cobalt was thought essential its elimination in ordinary enam-

els eliminates the bond as well. Recently there have been developed white enamels uncolored by cobalt, manganese, nickel or any other coloring oxides which adhere quite well to steel. The bond is of the same general nature as that obtained with cobalt ground coat. There is at the surface of the iron an interfacial layer which is black, being apparently saturated with iron oxide. The metal is etched and the glass penetrates in exactly the same way as in the case of cobalt ground coat. This coating eliminates the ground coat and in one fire may be obtained a white or any other desired shade.

Resistance to Mechanical Shock

One of the ills to which porcelain enamel is heir by the very nature of its composition is the fact that it is readily chipped. After all it is glass, and glass is fragile. There is little thought given to the fact that glass is quite a strong material, and our idea as to its fragility comes from the fact that as we get it, it comes in thin sections. Marble, tile, brick, or any of the common substances aside from metal would be more fragile even than glass did we have them in such thin layers. Glass, of course, it not ductile like the metals, and it requires a relatively small distortion to break a section of it. Naturally the thinner the section, the less the strain on bending and the less fragile. This is illustrated by the strength and flexibility of thin glass fibers.

It is the general impression that enamel ware is readily chipped. We have recently made a study of this problem and find that there are a number of misconceptions about it. In the first place, the blow necessary to crush glass or porcelain enamel is extremely high. It is surprising how much of a blow one can give a porcelain enameled steel surface without injuring it. This is true provided the surface is flat or concave and is not distorted by the blow. If, however, the enamel is struck on a convex surface, especially with a small radius of curvature, the chipping takes place quite readily, and an examination of articles which have been chipped in normal use show that the chipping usually takes place at edges or corners. This chipping we have found is due not so much to the blow as to the stress in the enamel itself. In order to explain this phenomena, we have to go into some discussion of the mechanical stress in the enamel. When a piece of glass and enamel are fired together, the enamel melts of course and flows out to form a smooth surface. If the temperature is lowered, a point is reached where the enamel solidifies. A further cooling results in a differential contraction between the glass and the steel. It is obvious that the contraction of the steel is greater than the enamel. If the steel were not bound by the glass it would contract to its normal length at room temperature. By virtue of the restraint imposed upon it by the glass, it does not contract as much. The steel is under tension. The enamel on the other hand and by the same process of reasoning is under compression. This compressive stress in the enamel may not be altogether undesirable as has been expected. In order to explain this, let us imagine a surface built up of bricks. If the surface is flat, it is obvious that a compressive force on the bricks will produce a more stable structure than one which is under tension. If the surface is concave, the force will in fact be very much increased, but this stress as, for example, the underside of an arch, is made stable by the compressive load on it. If, however, the surface is convex, this compressive force produces a stress in the bricks which is perpendicular to

the surface and away from it, that is, there is a component of the compressive force which acts to remove the brick from the surface. If we reverse the picture and take all these three cases with a tension applied, then it will be seen that a flat surface and the concave surface will be weakened by this tension while the convex surface will be strengthened.

Since glasses used in enameling always have a coefficient of expansion less than that of the metal, they are always under compression. The degree of compression depends upon the total expansion of the enamel between its softening point and room temperature. From this analysis, it seems that the problem is not so simple, since the convex surface requires for high stability a high coefficient of expansion while the concave and flat surface requires a low coefficient of expansion. Here we come to an understanding as to the difference in the nature of enamel used for various industries. In the stove and refrigerator industries the part of the artcle which is subject to chipping and mechanical shock is the convex outside surface, particularly at the sharp corners the force necessary to produce a chip is extremely low. It would therefore be desirable to use for refrigerators and stoves enamels having a high coefficient of expansion or perhaps those slightly higher than steel would even be desirable. For the kitchen ware industry where the chipping is most likely to take on the inside of the vessel due to thermal shock or stirring, it would be more desirable to have an enamel having a low coefficient of expansion.

We have in the past been concerned and dealt with the cofficient of expansion while as a matter of fact what we are interested in is the integral expansion between the softening point and room temperature. It may be of interest in this connection to describe a simple apparatus by which we have been able to make determinations of this integral expansion and its effect. A steel cylindrical ring formed into a circle is formed from a strip of steel one inch wide and about 8 inches long. Projections from the ends are welded together so as to keep the ring circular during the firing. It is covered with a uniform application of ground coat on both sides, fired in the normal manner and then coated on one side with the enamel whose properties are to be measured. After firing and cooling, the welds are ground off and the ring is free to be opened by the application of a force tangent to the surface of the ring sufficient to part the ends. This force is a measure of the stress in the enamel. We

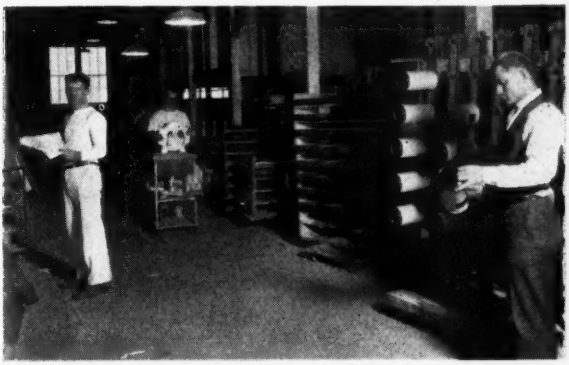

Fig. 5—Before any of the finished work is packed for shipment, each piece is critically eaxmined by a trained inspector. Rejected work is set aside while that which the inspector accepted is sent to the packing department where it is made ready for shipment.

have found that the force is proportional to the thickness of application and to the differential expansion of the iron and the glass. By this means we can compare two enamels and see which one produces the greater stress on the ring. When the force is large, the expansion of the glass is quite low in the range between the softening point and room temperature as compared with iron. When the force is low, the total expansion of the metal and the glass are close to each other. If we wish to produce a high stress as in the case of cooking utensils, we use an enamel which gives a high force. On the other hand in regular work where the enamel is applied on the convex side of sharp corners, an enamel which gives a low force is used. From diagrams which show the stress produced on curved surfaces it is obvious that the component acting in a direction radially from the center of curvature is greater the smaller the curvature in order to test this point, we made rings of various radii. In a particular case the rings were made of strips of steel, 6, 8, and 16 inches long, so that the diameters are in the ratio of 3, 4 and 8. An enamel was applied so that the application per unit area was the same in every case. The forces were measured in the usual manner and it was found that while the stress in the enamel is the same in every case, the force acting to close the ring increases as the diameter of the ring is decreased. If we plot these forces, we get a portion of a hyperbole. If we plot, however, the reciprocal of these radii or the curvature, we get a straight line passing through the origin. This indicates that as the curvature increases, the force becomes increasingly large. It is obvious from this discussion that the chipping of an enamel from a spherical surface having a 4 inch radius as compared to one having a ½ inch radius will be in the ratio of 1 to 8. At the edge of a piece of steel, the radius of curvature of the enamel is applied on the edge is quite small, and therefore the force is extremely large. In fact often the enamel will chip due to the stress in it without any mechanical shock from the outside.

Colors

It is a simple matter to produce colors, but to produce them so that the eye may not detect a difference between the color made today and that made one or ten years from now is a problem which requires not only skill, but exact-control and supervision. It is not uncommon to find that impurities which can only be detected by the spectroscope are the cause of color difficulties. The raw materials used are often of chemically pure grade or better. Their psysical structure must be known and controlled accurately. Materials having the same chemical composition but differing in physical properties often do not give the same results.

A relatively large number of the chemical elements enter into the manufacture of colors. Probably the most important is chromium which enters into the making or producing of yellow, brown, pink, green and intermediate shades. Cobalt, manganese, iron, and titanium are also important elements, but these few do not begin to exhaust the list. Many of the elements which are rarely used in industry in general find important uses in colors. The rarer elements used in ceramic colors are uranium, molybdenum, vanadium, neodinium and cerium.

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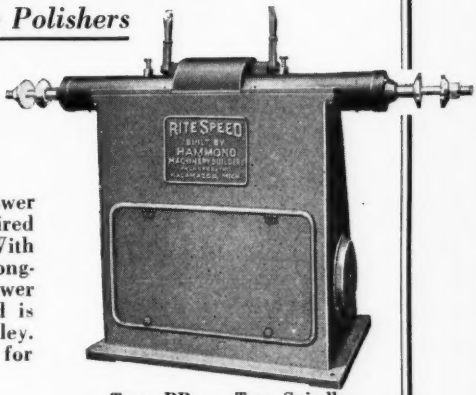

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Finishes of Today and Tomorrow

By S. P. Wilson, Ph. D.

The Varnish Products Co., Cleveland, Ohio

OF the devising and offering to the trade of new finishes there seems to be no end. Whereas a few decades ago an oleoresinous varnish, clear or pigmented, or a black bituminous japan were the only choices available, either for the decoration or protection of industrial surfaces, we now have what appears to be an almost unlimited array of organic chemicals with the film-forming power that is essential to the production of a finishing coating, and with uniquely characteristic properties of immediate or potential value. The rapidly accelerating tempo of chemical research and discovery is remarkably demonstrated by the speed with which the practically unknown chemical curiosity of today becomes a carload of familiarity of tomorrow.

While at first glance it would seem improbable that these novel materials will replace in any great measure the commonly accepted finishes of today, it must be borne in mind that first, lacquer, and then the synthetic alkyd finishes came in very rapidly to replace their previous competitors. Since no finish of today can be considered absolutely perfect, the field remains open for any distinct improvement.

The writer has often discussed, academically, the requirements for a perfect finish. This would be a light liquid of low viscosity, of 100 per cent film-forming content and requiring no solvent; it would be stable in its container yet capable of drying almost instantaneously after application to the required surface; it would have complete adhesion to any type of surface and have durability toward light, moisture, heat and abrasion as great as the life of the object tself. It would also be non-toxic and non-inflammable. Its price, naturally, would be low enough to permit its use on anything from a thumb tack to a locomotive.

Such a paragon is still unknown. Gradually, as our knowledge of the phenomena of oxidation and polymerization increases we will approach in our finishing materials more and more closely to the above ideal. In the meanwhile, with the old and new materials available, finishes are being made and offered to the trade with remarkable adaptation to the specific needs of the problem in question.

As old style, standard finishes (and distinctly with no intention of deprecating their very definite value) we may classify baking japan, oleoresinous varnishes using natural resins and oils, nitrocellulose lacquers using natural resins such as shellac, dammar and elemi, and the pigmented enamels made from the above products. With these finishes much excellent work has been done and will continue to be done. They cannot do all that the aggressive new-

comers to the finishing room can do, but they are inexpensive, they are reasonably durable and attractive, and they give very little trouble in the finishing room.

However, where the problems are more difficult, and the requirements more rigid, we must look into formulae utilizing newer basic materials. The oleoresinous varnishes and enamels made by substituting phenolic or special types of alkyd synthetic resins for the natural rosin, congo or kauri gums, will dry harder and sooner, will retain their lustre longer, will withstand moisture and heat better, will be more resistant to chemicals, abrasion and printing. The nitrocellulose lacquers using alkyd or modified alkyd resins will give fuller films, greater freedom from discoloration, greater durability toward sun, heat and chemical attack, and greatly increased adhesion and flexibility. These effects, however, are only improvements, not radical departures from the previous basic materials.

Of these newer finishes, we must classify as first both in extent of use and in the time they have been available, the true alkyd finishes. The word "Synthetic" has been so abused that anything with a modicum of a synthetic resin has been so termed and much of the confusion and trouble with synthetic finishes results from a lack of standards. The writer would consider as a synthetic finish only such products as are completely composed of a film-forming artificial product, an oxidizable or polymerizable resin, with such solvent pigment, plasticizer or stabilizer as may be needed. Alkyd resins, which are products formed by the condensation of polyhydric alcohols, such as glycerine polybasic acids, such as phthalic or maleic, and modifying fatty acid radicals extracted from various oils such as castor, soya, linseed, hempseed, and so on, are suitable for this classification. Oil enamels, using synthetic resins, even though excellently adapted to many purposes, should not in the writer's opinion be sold as synthetic enamels.

With this understanding, let us consider the alkyd enamels. They are capable of withstanding much higher bakes without discoloring than oil enamels and so are used widely in hospital furniture and refrigerator finishing. White alkyds, properly applied and baked, give very pleasing and durable finishes. Where lacquer was displaced, the slow setup required more care in eliminating dirt in the air, sometimes requiring air conditioning equipment. The high-bake installation required an expensive outlay, but where production is high and money for the installation available the material has proved satisfactory. The air-drying alkyds have found a place in the finishing of truck and bus bodies, where their high gloss and full body counterbalanced their inferior hardness and slow-drying compared to lacquer. These finishes have displaced much oil enamel and in the refrigerator and motor fields a percentage of lacquer. As yet it is doubtful if a finish of production speed, capable of being polished to an absolutely smooth and beautiful appearance can be prepared with this type of material, but for the purposes where it has been adopted it has been successful in a large measure.

Since these resins are subject to almost infinite variations, not only in the proportions of the ingredients used, but also to substitution, continual improvement is possible and we may well consider that alkyds will be with us a long time. Glycerol can be replaced by glycol or polyglycols, phthalic acid by succinic, adipic, or many others, the fatty

acids and combinations thereof are widely variable, and phenolic radicals can be coupled to the alkyd molecule giving further possibilities of variation. Control of the time and temperature variables in the condensation is also improving and this technique again leads to improvement.

Competing vigorously in the alkyd field are the newer nitrocellulose lacquers. These differ from the old in having a large proportion of alkyd resin and a much smaller ratio of nitrocellulose to resin than the original lacquers did. The presence of a proportion of nitrocellulose aids in securing a quicker setup and dry, greater hardness and freedom from printing and better resistance to water spotting. Owing to the greater viscosity of nitrocellulose the solid content is lower than the true alkyds, but greater than previous lacquers. The solvents are more expensive, as lacquer thinner must be used, but as a compromise embodying the best features of both types of finish the rapidly increasing percentage of this type of finish is no surprise. The adhesion and flexibility of the lacquers are tremendously increased, and even heat, known to be destructive to nitrocellulose, seems to have lost much of its power against the combination, as such lacquers can be heated to 300-400 deg. F. without destruction.

Leaving the alkyd resins we come to a new development of considerable promise. By combining urea and formaldehyde it has long been known that an extremely pale, tough resin resulted, and although technical difficulties were encountered, molded articles of this nature have been on the market for some years. The preparation of these resins in a form suitable for application as finishes was more difficult, but they are now available and being used. Their chief advantages are great hardness after baking, exceedingly light color and resistance to discoloration by heat and light. They require only a medium baking schedule, temperatures from 200 deg. to 250 deg. F. being adequate. They are somewhat deficient in adhesion and flexibility and in practice are generally blended with alkyds to overcome this difficulty. Modifications whereby urea is replaced by thiourea or alkylated ureas, and the formaldehyde by other aldehydes indicate possibilities for further development along these lines. At present, enamels made with this type of resin are more expensive than the usual synthetics, but where their qualities are required the cost is not excessive.

Similar in glass-like clarity, in resistance to discoloration and heat are the Vinyl resins. These are usually mixtures of vinyl chloride and vinyl acetate and are made from acetylene. The vinyl resins were initially adopted as molding compounds, but their present large consumption is due to the adoption of this resin as the chief ingredient for the coating of beer can interiors. An enormous amount of vinyl resin is used for this purpose annually, and naturally the interest aroused by this application has led to its wider use in other fields. Vinyl resins are heat and light resistant to a very high degree and give, when baked to about 300 deg. F. very hard non-yellowing and chemical-resisting films. They require special solvents, and the present use has required the production of tremendous amounts of methyamyl ketone and methylisobutyl ketone materials practically unknown previously but now produced cheaply and in large quantities through chemical ingenuity. Owing to the high viscosity of vinyl resins only a low solid percentage can be sprayed, and the lack of adhesion to some metal surfaces requires the use

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of a primer, generally an alkyd.

It may be well to mention here that from the longtime viewpoint both vinyl and urea resins occupy a position of unlimited scope, not only as coating but as basic structural materials. Many forethoughted chemists anticipate that in the future, with the depletion of iron and lumber resources proceeding apace, the structural elements will be aluminum, of which an almost unlimited supply is theoretically possible, and plastics. Of the possible plastics, only vinyl and urea resins seem to possess unlimited raw material. The alkyds depend on glycerol, which is at present scarce and high-priced and the phenolics or tar acids are also scarce and expensive. Vinyl resins however, need only carbon, limestone, water and salt as raw materials, and the urea resins carbon, air nitrogen and oxygen and hydrogen from water. Since these are basic and abundant raw materials, it is possible to conjecture a city of the future where furniture and flooring, tableware and buildings, vehicles and so on will be composed of aluminum and plastics with the remaining steel hoarded jealously to make the machines which mold out the plastics.

A still newer arrival to the coating field is similar to the above resins in color and discoloration resistance. These are the acrylate resins, polymers of methyl methacrylate. In addition they possess maximum optical clarity, and certain types have enormous extensibility in film form. are quite expensive but gradually entering the finishing field for certain limited special purposes.

Cellulose nitrate, and to a lesser extent cellulose acetate, have been long known as film-forming materials, drying by simple evaporation and giving hard tough films. The other cellulose derivatives have begun to appear in the finishing field. The ethers of cellulose, notably the ethyl ether, are rapidly increasing in popularity. The price of ethyl cellulose has dropped from $1.50 a pound to 75c within the year, indicating a rapid growth in production. Ethyl cellulose is very much better than nitro-cellulose in its resistance to discoloration, requires much leaner solvent mixtures, and is not inflammable. When heated to a high degree, it melts and chars but does not take fire. Using chlorinated hydrocarbon solvent, similar resins, and plasticisers, it is possible to make an ethyl cellulo lacquer that is practically fireproof both in the wet and dry state. Benzyl cellulose is also being used to a much smaller extent, and a new ester of cellulose, cellulose acetobutyrate, is being used where a specially high-grade clear metal lacquer is required, as for the protection of copper and brass articles under severe abuse.

Rubber derivatives are also becoming more and more widely used as finishing materials. Both the depolymerized form and the chlorinated rubber are used. Dissolved in naphtha, and modified with oils and gums, they make remarkably good concrete floor finishes, and owing to their acid and alkali resistance have found a measure of success in the metalcoating field.

The above brief review of some of the newer film-forming materials can be only of value in pointing out the presence of new factors in the finishing field, and emphasizing the need of keeping abreast with the rapid developments of pure research and technology. In a later article the writer hopes to outline some of the novel problems solved by some of these newer materials, and in addition to mention some of the solvents, pigments, plasticisers and other adjuncts to modern formulae.

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Physical Properties Of Abrasive Grain For Polishing Uses

By A. H. Anderson

Supt. Abrasive Grain Section, Norton Company.

WHILE the physical properties of abrasive grain for polishing uses can be measured and are controlled by progressive manufacturers, the user is only satisfied, and rightly so, by a performance test. These small grit particles have received much scrutiny and experimentation in recent years with microscopes of high and low power, projectors, capillarity testers, bulking weight machines, impact and abrasion resistance apparatus, briquets, chemical analyses and screen tests. Following all these must come the actual polishing performance tests in the laboratory before new products are submitted for field tests. One might feel that with such thorough examination that performance in the field could be predicted and only improved products tested by experience has shown that conditions in users' plants are too variable to permit this. Even different plants doing essentially the same work will usually vary enough in set up or use of polishing wheels to show large differences with identically the same abrasive grain.

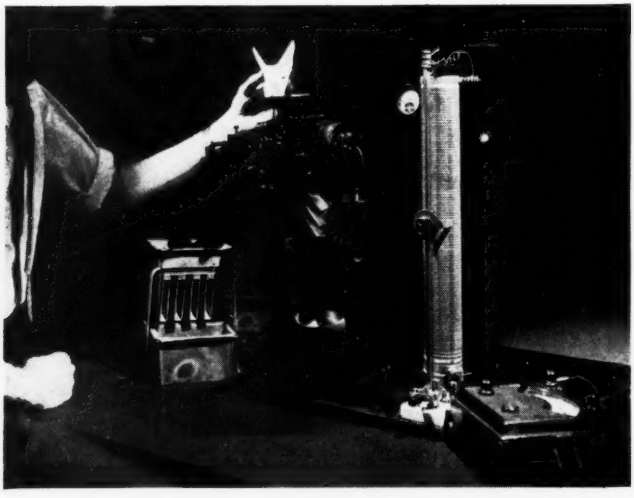

Fig. 1—Careful laboratory control at the plant assures proper characteristics in the abrasive.

When fused alumina was first introduced for polishing uses, all classes of work were more or less successfully handled by grain of uncontrolled shape and only one capillarity treatment.

Present day tendencies are to secure tools which are especially designed and fitted to care for small differences in requirements so that costs may be held at a minimum. This has led to a choice being now available of grain which will make polishing wheels of widely differing characteristics. Naturally such diversification has complicated the problems of grain manufacturer not only in regard to the variety of equipment needed to produce various physical properties but also the difficulty of carrying adequate stocks in warehouses and factory. The user, who is the man to be satisfied, is the gainer as today he may select from grain shapes and surface treatments the one best suited for the job. Where formerly one product was available, now this same product has been altered physically in such ways that polishing wheels will act differently in regard to life, finish, rate of cut and amount of heating. Still the alterations of the original basic grains are under strict laboratory control and once established, duplication can be relied upon.

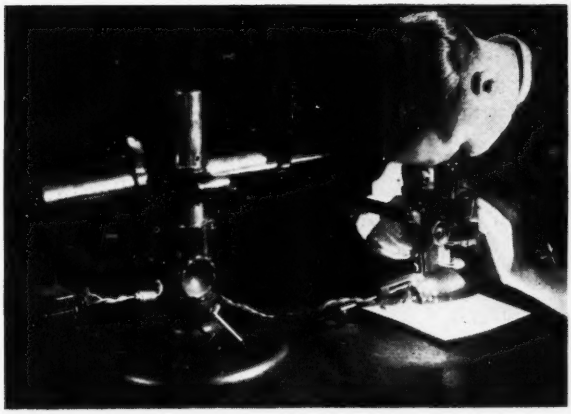

Fig. 2—Abrasive grain shape and size is studied and checked under high magnification.

With the proper knowledge of electric furnacing of polishing abrasives one builds into them such desirable physical properties as extreme hardness and toughness, uniform chemical composition, and proper crystal structure. Subsequent crushing and preparation of grit sizes suitable for polishing are where the technique is applied to control grain shapes, prepare grain surfaces to give the most suitable bonding strength with glue screen size to conform to industry standards, and packaged in such a manner that capillarity of the grain will not be lowered between time of manufacture and use.

To list the physical properties of polishing grain in order of their importance will not be attempted as these depend on the particular job in hand. Some work requires for best performance, grain which will bond very strongly with the adhesive and which has maximum toughness, while other work would require grains that are more friable and with surface treatment such that they are easily dislodged under light pressures. These characteristics have long been recognized and made use of in solid grinding wheels but only recently have been applied to set-up polishing wheels. Again one can call to mind jobs where uniformity of particle size, that is, freedom from oversize and undersize, is of first importance while another can be done suitably or sometimes even better by a mixture of two or more sizes.

Certain it is that consumers can now expect and insist on a uniformity of polishing grain which was not pos-

Fig. 3—Grain capillarity is an important factor and is therefore carefully measured.

sible a few years ago. While it would require much equipment and technical skill to check all physical properties of incoming shipments, it is possible to readily examine two of the important qualities, namely, grit sizing and capillarity. The Abrasive Grain Association has established limits for the industry covering these properties as well as specified suitable equipment for making the laboratory tests. This information is available for any user who wishes to protect the quality and quantity of his production against breakdown which might come from lack of uniformity of the polishing grain.

Everseal Modern Industrial Maintenance Finishes. This is the title of an 8-page bulletin describing F. W. B. floor finishes, mill whites, dado enamels, aluminum finishes—exterior and interior, metal trim enamels, machinery enamels, spar varnishes, alcohol-resistant varnishes, and so on, which has been brought out by the Everseal Manufacturing Co., Inc., Broadway and 57th St., New York, N. Y. The F. W. B. Everseal line of industrial finishes are based on Bakelite resins. Bakelite resins are said to exert a marked fortifying effect upon paint and varnish films. They increase the outdoor life of finishes by "stepping up" resistance to sunlight and weathering. Field tests and accelerated tests in the laboratory demonstrate their remarkable resistance to moisture, a most important requisite in combating the deadly effects of rust and corrosion. Bakelite resins are said to impart to protective coatings unusual elasticity and the retention of elasticity on aging. The ability of a finish to withstand abrasion or chipping is of paramount importance whether it be a floor varnish, a tank coating, or a metal enamel. Thus, the inherent toughness which Bakelite resins contribute to finishes is a vital factor in the general "fortifying effect" of these resins. A copy of this bulletin free upon request.

Baldwin-Duckworth Non-Corrosive and Heat Resistant Chains Bulletin No. 59. The machine finished power transmission chains and roller chains made by Baldwin-Duckworth Chain Corporation, Springfield, Mass., are described and illustrated in an eight-page folder which is now being distributed by that firm. The bulletin includes a table showing the resistance of the stainless steel used in these chains to various types of corroding agents. Specifications and prices are included. Copy free upon request.

Collordata. This is the title of a beautiful 16-page booklet now being issued by Collord, Inc., 7049 Lyndon St., Detroit, Mich. The story of adhesives and their applications in modern industry is explained and illustrated. Such items as dipping baskets, anode scrap savers, and primers are also described and illustrated. Copy of Collordata free upon request.

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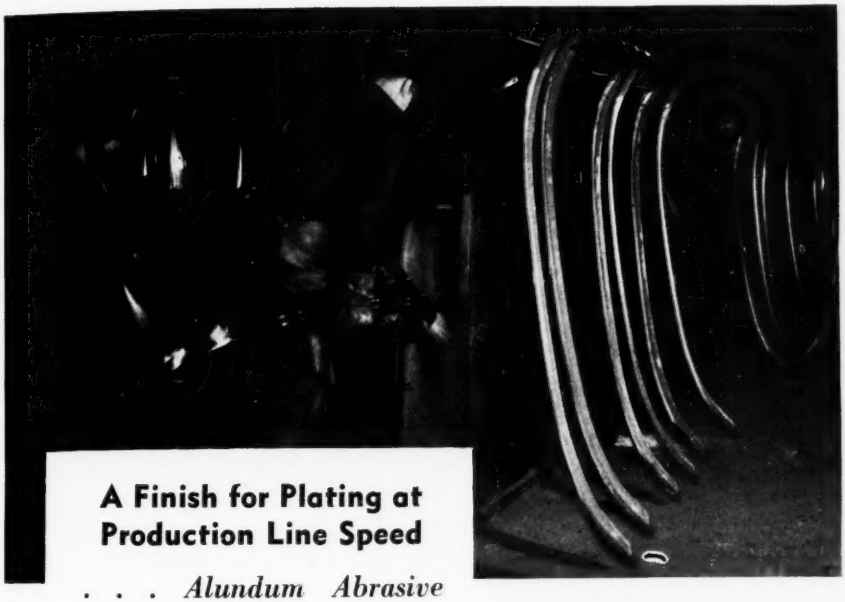

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Barrel Burnishing of Metal Products

This the sixth article of the series presents a barrel burnishing questionnaire.

By H. Leroy Beaver

FROM the publication of the first paper of this series covering the Barrel Burnishing of Metal Products, each succeeding paper, touching a different phase of the subject, has brought forth numerous inquiries from readers of Products Finishing concerning individual problems in their own operating cycles. In all of these inquiries there was no single instance where sufficient information was given to enable us to respond with a solution without first engaging in additional correspondence. For this reason, and also to save the time both of respective inquiries and ourselves, we have prepared a questionnaire consisting in the main of thirty-five questions, each with an explanatory note.

Not all of the questions will be applicable in every case, but they are all important and should be answered as completely as possible because the answers are necessary in order to present a complete picture of the burnishing operation as carried on in each individual plant. Once we are familiar with your complete procedure, it will enable us to readily say whether we can be helpful in suggesting changes or variations of either methods or materials in the light of the latest developments in burnishing practice.

May we make it entirely clear that, in sending in your answers with a request for an analysis no charges of any kind will be involved. All requests will be numbered in the order in which they are received and will be answered in the same way. In cases where it may be necessary to conduct some actual experimental work there may be a delay in transmitting your answer, but all answers will be expedited as much as possiblue. No limit is placed on the number of pages that may be included in your answers to the Questionnaire. We do, however, request that your answers be as complete as possible irrespective of the number of pages required. Your answers, for the sake of clarity, should be numbered to correspond with the question numbers.

1. **How many burnishing barrels what type and size and of whose manufacture do you operate? Which of the barrels are wood lined and which cast iron or some other material? Do you operate any barrels made from brass, bronze or aluminum, and for what reason? If you have built your own barrels please describe them fully not omitting length and width and material from which they are made. At what r.p.m's do you operate each of these barrels? (We assume that when you purchased your barrels you advised the barrel**

manufacturer regarding the quantity of parts required to be burnished daily and that your barrels were purchased to fulfill your maximum production requirements.) It would be desirable if you would state your production requirements for each barrel.

Note: In the preparation of a burnishing analysis we use a squared and numbered chart which, when we have noted upon it your answers to these questions, immediately presents to us a picture of your barrel burnishing operations. The purpose of this first question is to enable us to know just what your burnishing equipment consists of, and in the light of your answers to subsequent questions determine just how closely it meets your requirements. Many of the questions are directly related to other operations which probably will not immediately be discernible.

2. **What weight in pounds, or quantities measured either in quarts or pecks of burnishing materials; that is, balls and/or other burnishing shapes, not considering parts to be burnished, do you operate in each barrel?**

Note: The purpose of this question is to enable us to judge as to whether you are using too much or too little material, which indicates whether you are operating efficiently or inefficiently, and to enable us to advise you and to correct your operating proportions. When the weight figure in respect to your burnishing materials is known, it immediately enables us, by reducing the pounds to quarts or pecks, to determine if the quantity is correct. This is not true, however, of the parts to be burnished, so do not give the weight of the parts but rather the quantity either in quarts or pecks per barrel load.

3. **Do you use round balls only, or some combination of balls and other shapes, or burnishing shapes without balls? Please advise just what combination of burnishing materials you do use.**

Note: This question is important when connected with a later one concerning description of parts to be burnished. In answering simply state whether you use all balls, balls and cones, balls cones and slugs, or cones only, whichever the case may be, and the proportion of each. If you use shapes other than the above, then simply give the entire make up of the burnishing mixture, naming the shapes and sizes and proportions of each.

4. **What proportion of burnishing materials do you use in proportion to parts to be burnished? The quantities should be stated either in quarts or pecks?**

Note: This question is also important for, as we have heretofore pointed out, the rule of two parts of burnishing materials to one of parts to be burnished that has been used these many years is by no means an infallible one. If we know your proportions, then we can determine for you, from the answers to later questions, the most beneficial proportions for you to use.

5. **How much water do you use per load in each barrel, and is the water "hard" or "soft"? If "hard", state how many grains of hardness. (This information can be supplied by your water company and is important.) Do you know if the water you use contains any unusual proportion of mineral matter such as iron, sulphur, and so on?**

Note: When we know the quantity of water you use and its hardness in grains we can then immediately know whether you are using too

much or too little soap, depending on the type and kind of soap used. The harder the water, the more soap is required to give the burnishing solution its proper and necessary lubricating qualities. This information also enables us to advise you how to soften the water, thus securing more efficient action as well as effecting a saving on the quantity of soap used.

6. What kind of soap do you use in making up your burnishing lubrication solution? How much do you use, either by weight or measure, to each barrelload of work? Whose manufacture, if you know, or its trade name, and whether in chip, flake, powder or soft soap form or liquid? What is its titer? (This information can be supplied by your soap salesman). Do you add the soap to hot or cold water in the barrel? Answer in detail, please.

Note: This is an exceptionally important question, for the reason that practically every manufacturer of soap has a panacea to offer for all barrel burnishing work. Most soaps sold for burnishing are in reality "household" soaps, and more than this is required for proper barrel burnishing application. The production in many plants never rises above the commonplace—so far as their barrel burnishing is concerned—due solely to the use of improper burnishing soaps. There are too many genuinely good burnishing soaps on the market for any operator to use a soap that will not give the proper and necessary lubrication.

7. Have you a supply of hot water available in your burnishing department, for rinsing after the burnishing process has been completed?

Note: Practically all of the better grades of burnishing soaps are made from tallow base; some "hard" tallow and others "soft" tallow. The averages of these soap tallows will crystallize at around 104 deg. F. Hence the importance of hot water, first for securing the most rapid incorporation of the soap into the burnishing lubricant solution and second to provide for more thorough and complete rinsing of the parts as they come from the burnishing barrel.

8. What is the composition of the parts you barrel burnish—steel, brass, bronze, monel metal, aluminum, cadmium, zinc, white metal, copper nickle or chrome plate? How long do you find it requires for you to secure a satisfactory finish on any of the above metals; that is, what operating barrel time?

Note: Steel parts are covered by a later question. On any of the nonferrous metals give the analysis or mix if possible. The purpose of the question is to enable us to recommend wherever possible easier forming or finer finishing analysis, by suggesting changes but not departing from standard stock formulas.

9. Do you barrel finish any parts coming under the general heading of "moulded products" or parts formed from quite a long line of what are known as "plastics", and illustrated by such materials as bakelite, condensite, pyralin and catalin? Do you opoperate these wet or dry and with steel burnishing material or some other finishing product? Do you barrel finish any products formed from "abalone" shell? If yes to any of the above, what is your procedure, briefly outlined?

Note: The "plastics" to which we refer above may be either moulded or turned from stock and then finished. While not coming strictly under the head of metal products, their relation is such due to their use in

combination with metal parts that are also barrel finished, that it was felt they should be included in the questionnaire.

10. If you copper plate on steel do you use cyanide or acid copper solution? Do you barrel burnish both before and after copper plating?

Note: In many plants steel stampings are barrel burnished then copper plated and then burnished again prior to nickle plating. One of these operations can be eliminated. This question is to effect contact with those operators who are double burnishing these parts so that they can be informed on the new procedure.

11. If you barrel burnish parts made from non-ferrous metals, do you use an acid bright dip before burnishing? If so, what is the formula for this bright dip?

Note: There are so many formulas for bright dips and they vary so greatly both in composition and operation that the purpose of this question is to gather together as many of these as possible, tabulate them, and then select the one seemingly meeting with the most success in practice, so that it may be recommended as the most widely accepted formula.

12. Inasmuch as it is extremely important that the inner surfaces of the burnishing barrel and the metallic burnishing materials as well be kept scrupulously clean, what method do you employ for cleaning the parts to be burnished prior to placing them in the burnishing barrel for operation? Give the formula of your cleaner, if possible, or Trade Name, or name of maker. Do you use still tank and of what material? Do you use electrolytic cleaner, vapor degreasing or acid pickle? Describe briefly the process you use.

Note: Cleanliness is so vitally important to successful barrel burnishing results that we are anxious to secure as much data as possible on this phase of the subject so that we can, as we do in other phases, tabulate the information to arrive at some definite standard. We therefore would appreciate an outline from you as to just what you use and the method in which you use it and the results you obtain. If we can, we will suggest changes along the lines of the best current practices.

13. Assuming that you unload your burnishing barrels by the conventional method of dumping the entire contents into a double unloading pan consisting of a screen to separate the work from the burnishing materials, what method do you employ for returning the metallic burnishing material to the barrel?

Note: Of the thousands of burnishing barrels now in operation, it is a sad commentary on progress when we are obliged to admit that in only one case and with one maker, have we anything like a loading device for returning the burnishing material to the barrel after the completion of a run. Aside from this, we are apparently still in the "scoop shovel" age. This involves a terrific waste of time and man power. Very frankly, this question is purposely inserted in the questionnaire to bring this matter to the attention of barrel manufacurers generally. It would seem to us that an opportunity exists for the barrel manufacturer who will redesign his equipment in accordance with modern practice. If any of the readers have rigged up a device of their own, sketches of it would be appreciated, and will be used later so that we can make the path of

travel a little easier all the way around.

14. Is compressed air available in your burnishing department of at least fifty (50) pounds pressure?

Note: The purpose of this question is to enable us to suggest, in case you do have air available, a simple device for reloading the burnishing material into the barrel. Simple in operation and ridiculously inexpensive.

15. If you barrel burnish brass or other non-ferrous parts in either conventional burnishing barrels or oblique tilting barrels, using cream of tartar or a synthetic cream of tartar solution, state quantity of cream of tartar or substitute, and also quantity of water you use to each load of work? Also quantity of parts operated in one loading, expressed in either quarts or pecks, and the length of time you operate to secure satisfactory finish. Do you use steel balls or shapes or any other burnishing materials in the cream of tartar solution operation?

Note: There seems to be considerable haziness as to the operation of this process and the purpose of the question is to co-ordinate information on the operation so that a definite standard may be set up. Do you or have you ever used a dilute acid solution instead of cream of tartar or its substitute, and if so, what results did you secure?

16. If you barrel burnish both steel and non-ferrous parts do you use the same barrel for each, or do you operate separate barrels?

Note: The reason for this question is that if you operate separate barrels for each, we have an interesting formula for burnishing steel stampings we would like to send to you.

17. If you burnish castings of either brass, bronze or iron, what sand do you use in the moulding of these parts? If sprues, gates, fins, burrs, surface ridges or other defects or imperfections appear on the castings as they come from the sand, what grain or grit of wheel do you use for their removal prior to barrel burnishing. What process of scale removal do you use?

Note: This question relates principally to foundry procedure prior to barrel burnishing. Give us an outline of your procedure and we may have some interesting suggestions for you.

18. Do you barrel burnish die castings, and if so, of what composition, and what is your present procedure? Have you ever used the so-called "dry burnishing," method on zinc base die castings? If so, explain in detail.

Note: Quite recently a "dry burnishing" method has been advocated for this class of work. This so-called dry burnishing is more often used on the lighter specific gravity products such as the line of "plastics" heretofore mentioned. Have you ever "dry burnished" any products? If so, an outline of your procedure will be appreciated. We will be able to give you an outline of the present best practice of the dry process.

19. What method do you employ for drying the burnished parts after they come from the barrel and are rinsed clear. If you use saw-dust, do you use it in a revolving barrel, a heated barrel, cold or hot drying tray, double screen box with riddle, or do you use a centrifugal

dryer?

Note: To many operators sawdust simply means so much jagged pieces of wood fibre. Maple is the generally accepted "best" material and the most widely used. As between the conventional saw dust and wood flour we have a very different functioning material. The flour is much the more satisfactory. For a long time in our research work we used wood flour from a textile machinery plant. The most of it came from the dust accumulators attached to the sanding machine. We could not get the results we wanted from its use and finally realized that in addition to wood flour, we also had small particles of sand and glue coming from the sanding wheels. For quite a long time we have been using what we call a fibre flour. This is composed of maple wood, yellow corn cobs, the pithy stalk of yellow corn without the leaves, and the bagasse of sugar cane thoroughly dried and then ground into a flour on a hammer mill. By grinding this material into a fine flour we have a splendid drying out material and it also lends itself well to the addition of abrasives for deburring on very light parts. This material has given us results far beyond anything we could ever secure from simple wood flour or saw dust.

20. Do you use a "cutting down" barrel, and if so, for what purpose; such as cutting down, removal of scale, reducing surface, removing burrs, &c?

Note: The size of barrel you use for this work, and the largest load you can carry are the features that interest us. There is a direct relation between size of barrel used and weight carried and when in proper proportion the "cutting down" operation may be comparatively inexpensive. Under other conditions the cost may be entirely too much in proportion to the volume of work in process. The purpose of this question is of course to learn just what your procedure is and to see whether it is possible to present any suggestions to you that would increase your production and decrease your operating costs.

21. If you use an unlined barrel for cutting down work, what is its size, what abrasive medium do you use, and in just what manner? Do you use the abrasive and parts alone or do you add some medium for supplying additional weight to the mass. If so, what? Is this operation performed wet or dry? State quantity of load and length of time required to achieve desired surface finish?

Note: This has to do with a process for gaining faster operation and more nearly uniform action. Also for the purpose of setting up a standard of operation for various types and sizes of cutting down barrels.

22. What method of cleaning do you use after the cutting down operation?

Note: This question for the purpose of determining the most widespread practice now in use and also to tabulate and establish a standard for cleaning after cutting down.

23. If you barrel burnish after any operation where either a buff or set-up wheel with composition has been used to touch up imperfections in parts, is the base grease of the composition you use such as would be designated as 100% saponifiable?

Note: This has to do with elimination of insoluble greases that deposit on the inner surfaces of the burnishing barrel and on the metallic burnishing material and parts being burnished.

24. If you barrel burnish steel stampings are they formed from original strip steel work, and if so how many passes through the rolls? Do you purchase blanks for stampings cut from off-cuts of other manufacturers?

Note: This has to do with the character of the "skin" on strip steel used for stampings, and the latter part is to determine what degree of uniformity is found on parts made from off-cuts. This latter practice has grown in proportion of late and not always with the happiest results.

25. If you fabricate stampings can you give the hardness of the strip expressed in either Rockwell "B" or "C" Scale, Brinell or Scleroscope hardness? If you do not purchase your steel by any of the above standards of hardness determination, then do you use hard tempered, medium tempered, soft or dead soft annealed?

Note: As a general rule it may be stated that steel stampings should be made from the hardest material that will form properly between the dies. Parts formed from steel in Rockwell "C" scale range or from hard tempered strip will present a far better color when barrel burnished than when strip in Rockwell "B"' scale or soft annealed stock is used.

26. On any of the products you barrel finish, do you use an acid pickle? If so, give composition. Do you use still soak in the pickle or do you agitate the work in a basket? Have you ever bright dipped steel parts prior to barrel burnishing? In your acid pickle what do you use as an inhibitor, and what as an acid neutralizer after the pickling operation?

Note: This also has to do with the establishment of a standard of practice in which all barrel operators should be interested. The majority results of all of these problems relative to the setting up of standards of practice will be co-ordinated and reported later.

27. In barrel burnishing where soap water is the medium for providing lubrication, is this lubricating solution in your barrel thin and watery or is it rich and creamy?

Note: This has to do with what has been demonstrated to be the best established practice. Your answer will naturally assist us in outlining for you the best regarded practices, taken from a series of observations on research work covering a period of years.

28. When you have finished operating your burnishing barrel or barrels for the day, just what do you do with your burnishing material to protect it from rust and corrosion?

Note: There is only one "best" practice to follow with regard to the above, and your answer will enable us to correct for you any variation that you use not in accord with the definitely established standard.

29. If through oversight or some other cause your burnishing material has become rusty, just what did you do about this?

Note: Here also we have developed a standard of practice covering the reclamation of steel burnishing materials that have become rusted in use. There is only one safe method to follow, and in case you have had rusted material and will advise us what you have done about it, we will outline for you the proper procedure.

30. Do you use oblique tilting type tumbling barrels for any "burnishing" operation, either with

wood or metal shell, and if so, for what purpose? Outline your procedure.

Note: We are seeking data to learn to what extent barrels of this type are used in burnishing practice. If you are using such barrels, it will be appreciated if you will give us an outline of your procedure so that we can check this against our standards chart. In turn, we will give you the results indicating the best-established practice.

31. Do you know, or can you ascertain, the average of specific gravity of the metal parts you barrel burnish? This has a direct relation to a process for barrel burnishing?

Note: The problem of the relation of specific gravity as applied to the barrel burnishing of metal products is not widely enough understood. It is a generally accepted fact that the average steel burnishing material mass has a specific gravity of 4.9. This question relates to a method for handling metal parts whose specific gravity is less than that of the burnishing material mass.

32. Have you ever noticed any staining of your work as it comes from the burnishing barrel? We here refer to a cast iron barrel shell with maple liners? After the barrel has stood for some time containing the burnishing material covered with water, in dumping this water does it run clear, or with a grayish, brown, or black cast, occasioned first by hydrolysis of the soap you use, second, release of iron oxide from the barrel shell that seeps through the wood liner into the burnishing compartment, or of free graphitic carbon also coming through from the outer cast iron shell?

Note: The purpose of this question is to determine to what extent the above features handicap further finishing operations without an intermediate cleaning or acid dipping, and applies especially to non-ferrous parts. If you have had difficulty in this regard we have a pertinent suggestion to offer to you; one that will add much to the quality of finish you secure from your barrels.

33. What was the determining factor in your purchase of the particular barrel or barrels you are now using, both as to type and size.

Note: The purpose of this question is to tabulate data as to how close to performance claims of manufacturers of barrels has been realized by purchaser-operators. May we have your experience on this phase?

34. If any of the parts you barrel burnish are of such form that they required racking in the barrel or spacing, please describe the method of racking or spacing you use, as well as the type and size of barrel.

Note: Here again we seek to learn to what extent racking of parts for burnishing is used. In many cases with which we have come in contact the operation was entirely practical and splendid results were secured, while on the other hand, cases were found where the process, while mechanically possible, was not commercially practicable. We wish to know to just what extent your racking methods have been successful.

35. Is there any feature of barrel burnishing that you do not understand, or have you a problem now before you for solution?

Note: As we have so often stated previously, both in and out of print, we do not know all of the answers, nor can we at this time predict the ultimate possibilities of barrel burnishing. All we can do is to offer such

information as we have gained over years of research and that may be of help to any of the readers of Products Finishing. So if you have a problem, do not hesitate to present it. If we do not know the answer we will frankly tell you so, and will do all that we can in an experimental way to assist you in finding the solution to your problem. You may make your answers just as fully and frankly as you desire and to whatever length required. Your answers will be in strict confidence and no names either of companies or individuals will be used in connection with any papers in the Barrel Burnishing Series now being published. In Barrel Burnishing, as well as in other divisions of metals finishing, PRODUCTS FINISHING only seeks to be of the greatest help to the greatest number and invites you to avail yourself freely of the facilities afforded by its staff of consultants.

Hand Propelled Cleveland Tramrail Carriers with Motor Operated Hoists. This six-page folder, printed in colors, describes and illustrates a wide variety of installations in which Cleveland Tramrail Hand Propelled Carriers with motor operated hoists are used. It also explains the design of the hoists and illustrates, by means of photographs, the various parts which enter into the construction of the hoist.

Not the least interesting are the various types of hooks, baskets, and other types and designs of equipment for lifting and transporting workpieces, material in lump or powder form, foundry flasks, sheet metal, lumber, ladles, wire rope, dipping baskets, pipe, paper rolls, and so on. Copy free by addressing Cleveland Crane & Engineering Co., Wickliffe, Ohio.

No. 60, Volume 27 of "Grits and Grinds", publication of Norton Company, Worcester, Mass., is devoted entirely to the subject of cylindrical grinding. Beginning with a condensed history of the development of the cylindrical grinding machine, the author takes up in turn the subjects of cylindrical grinding wheels, trends in design and practice, grinding methods, various cylindrical grinders and their uses, grinding in the angular wheel slide machine, roll grinding, crank pin grinding, cam shaft grinding, car wheel grinding, and closes with a table of cylindrical grinding wheel recommendations. This copy should be of prime interest to every executive connected with cylindrical grinding. Copy free upon request.

Test for Acid Resistance of Porcelain Enamels. This is the title of a publication which has been prepared for manufacturers, distributors and users of porcelain enamel products by the Porcelain Enamel Institute, 612 N. Michigan Ave., Chicago, Illinois. This booklet was prepared under the direction of the Institute's committee on test standardization, of which W. N. Harrison of the National Bureau of Standards, is chairman. The test which has been in the course of preparation for the last year or more is termed as a "tentative standard" and will continue in its present form until it is supplanted by a standard test for acid resistance. Described in this publication are the "room temperature" test and "boiling" test. Complete instructions are given under each classification for simple methods of determining the acid resistance of porcelain enamels. Copy free upon request.

Foxboro Bulletin DMF 714. The Foxboro Company, Foxboro, Mass., has recently published a bulletin that illustrates and describes typical Foxboro Electrical Distance Transmission Instrument installations, particularly as applied to flow meters and liquid level gages. This will be of interest to plants with a problem of locating instruments on a central panel for accurate and dependable results far from the process. The transmission system employs two self-syncronizing electric motors to transmit the readiness of flow or level between the transmitting and receiving instruments, insuring extreme accuracy for use 2,000 or more feet away. The system also permits the location of the control instrument at point of measurement, and the use of air for control. This means full floating control action and control that will not stop on interruption of electric current. Copy free upon request.

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Aluminum Finishing Procedure, III

By Robert T. Griebling

Aluminum Company of America

EXTREME hardness is a dominant characteristic of the oxide coatings formed on aluminum by electrolysis. This quality is akin to that of the sapphire and the ruby, for both stones—forms of aluminum oxide—are physically the same, and are members of a family which includes emery and corundum.

The cowpuncher's life is a rough one, no matter in what country he plies his trade. He likes gaudy clothes and fancy saddle trimmings. In Argentina he goes in for stirrups such as these, cast in aluminum and colored brown by the Alumilite process, with the highlights in the metal's natural color. The Alumilite process also furnishes the stirrups with an abrasion-resistant coating.

The application of aluminum oxide coatings to cafeteria trays is an excellent illustration of putting this hardness to work. Uncoated aluminum, as used in these trays for many years, has a tendency to smudge, but such a condition is avoided when the metal is properly protected with a coating applied by the Alumilite process.

The efficient performance of aluminum pistons in internal combustion engines is too well known to require explanation here. Practically every motor car manufacturer uses aluminum pistons today, some of them furnished with an aluminum oxide coating which becomes impregnated with lubricating oil; this combination surface prevents scuffing when the motor is started in cold weather. Such pistons give long and excellent service.

The oxide-coating of die-cast sliding parts used in gasoline measuring pumps is done primarily to provide resistance to abrasion, and is another example of the proper place in which abrasion-resistant coatings should be applied.

Bus and street car handrails are quite often supplied with the oxide coating, as are escalator sections. In the latter case, the lustrous coatings enhance the beauty of the gleaming metal and make cleaning an easy matter, but it must not be forgotten

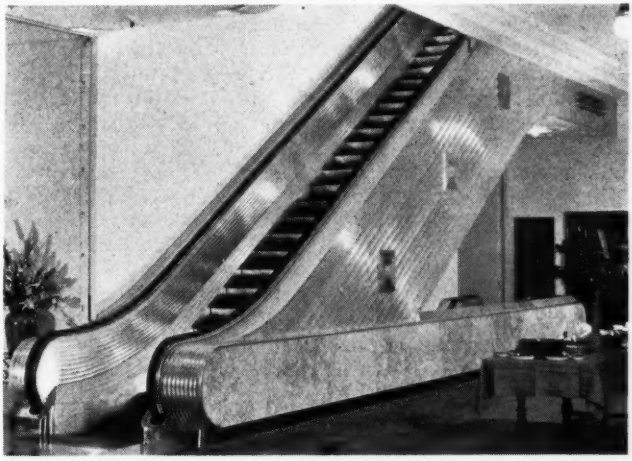
Two types of aluminum pistons commonly used in automobile engines. The one on the right has been given an abrasion-resistant coating colored black.

that escalator sides are exposed to considerable scuffing, which the oxide coating resists to a considerable degree.

In the rayon industry the finished yarn is wound on rapidly revolving spools. As the loose thread whirls about during winding, it forms what is known in the trade as a balloon. Since the spools are close to each other, there is always the danger that they may be thrown out of service if the balloons become entangled. To prevent this possibility, separator plates are placed between the spools. The balloons hit the plates and are thus kept within bounds. These plates are fabricated of anodically coated aluminum and their exposure to abrasion is continuous.

Motion picture film abrades the surface over which it is so rapidly pulled. As a result, the manufacturers of motion picture cameras and projection machines fabricate their aperture plates of aluminum and coat them anodically.

Rubber molds are frequently made of alumnium. The preservation of the sharpness of their contour is important for good results, and many of them are given an aluminum oxide



Few who travel on these gleaming escalators in Marshall Field's new Chicago store are aware of the fact that the aluminum in the construction of the sides has been given an abrasion-resistant oxide coating which preserves the lustre of the metal underneath.

Millions of nameplates are made each year. Many of them are modest little gadgets, with few or no pretensions. Others, however, are excellently designed, many in color, and they attract attention to the message they convey. They can be coined, embossed, stamped, cast, engraved, or etched. Those in the photograph are aluminum and have been finished by the Alumilite process.

coating so that the abrasion found in the manufacture of rubber goods does not round off the sharp corners.

Aluminum has made great strides in architecture in the last ten years because of its many desirable qualities. A relatively new use in this field is aluminum weatherstrip, which is oxide-coated. Excellent results are obtained, even with a very thin coating.

Aluminum guides and tabs for letter files are coated to prevent the smudging of aluminum on paper. The tabs have been coated and then colored black. They replace enameled tabs even though they cost more, because with the new product there is less frequent need for replacement.

Millions of aluminum nameplates are made each year. Many of them are coated, not only because they can be attractively colored by the Alumilite process, but also because the coating fortifies them against abrasion. Resistance to abrasion on the part of the nameplates is not generally thought of, because these plates serve only to give the name of the manufacturer or else indicate the uses and the proper operation of the product to which they are attached. It has been found that oxide-coated nameplates resist abrasion from cleaning far better than uncoated or enameled plates.

Office furniture trim is often made of aluminum moldings and castings. It is coated to prevent smudging of clothing, hands and shoes. Kick plates on swivel chairs are an example of this application.

There has been a definite need for abrasion-resistant coatings on aluminum for some time. They have not only served to develop new markets for the metal, but in many cases they have succeeded in retaining a market that might have been lost to another material. They are of importance in the metal world because they increase the versatility of a metal which is already to be found in thousands of applications in almost every industry.

Erratum

On page 18 of our April issue there appeared an article entitled "Bullard-Dunn Process". We neglected to mention that the process and also the use of high silicon-alloy anodes to prevent the formation of ferric ions are covered by several patents. License to use the process can be obtained from The Bullard Company, Bridgeport, Connecticut; Langbein - Pfanhauser - Werke, A.G., Leipzig, Germany and W. Canning & Co. Ltd., 133 to 137 Great Hampton Street, Birmingham, England.

We regret to state also that The Bullard Company has brought to our attention that the article contained a number of errors, and consequently at a later date we expect to publish another article, authorized by The Bullard Company, which will give accurate information summarized from the records of many of the installations now operating successfully here and abroad.

Industrial Guide for the Proper Selection of Wire and Cable, a 32-page publication designed to help clarify present day practice involving the selection and application of wire and cable. It is published with a view to serve engineers who are confronted with ticklish wiring problems, more as a means for reviewing the available types of wires and cables to meet conditions, than as a substitute for personal diagnosis and treatment of wiring problems.

Factors affecting the selection of wire and cable and a treatise on the importance of up-to-date wiring design in relation to avoiding industrial headaches are discussed. Colored lay-outs illustrate typical power supply circuits and tables covering practical limitations to be considered are included in these discussions.

Nine charts for recommending insulation and protective coverings to meet exposures and conditions of use are so arranged as to make for ease in selecting the wire or cable for different industrial circuits. For your copy, write to the Anaconda Wire and Cable Company, 25 Broadway, New York, N. Y.

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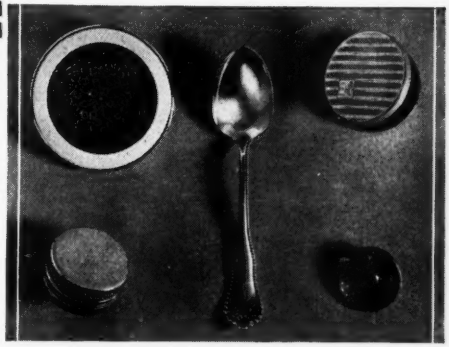

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THE PURITAN MFG. CO., Waterbury, Conn.

the FINISHING FORUM

Question: I should like to convert the alkaline cleaner in our automatic plating machine into an electrocleaner. Please tell me whether to connect the cleaner to the generator so that the current will flow in the same direction as it does in the plating tank or vice versa.

Answer: Opinions differ concerning the direction of current in electrocleaners. The most general usage dictates that the current flow through the cleaner in the same direction that it flows through the plating tank; that is, making the work the cathode. There are several good reasons for making the work the cathode in electrocleaners. In an electrocleaner the passage of current causes electrolysis of the water in the cleaner. The water is decomposed into its constituents, hydrogen gas and oxygen gas, there being two volumes of hydrogen formed for each volume of oxygen. The oxygen is given off at the anode and the hydrogen at the cathode in the cleaner.

Since a greater volume of gas given off at the surface of the work means a much faster cleaning, it is advantageous to make the work the cathode and thus get twice the volume of gas that would have been available if the work had been made the anode. However, for some base metals, it has been found that making the work the cathode causes stain and results in subsequent rejected work. If the cleaning solution contains small particles that may become charged and plated onto the work, there may also be a possibility of subsequent lifting or blistering of the plate. Bearing these two possible objections in mind, it is safe to say that the proper way to connect an electrocleaner to the generator is to make the work being cleaned the cathode and to make the cleaning tank the anode. To prevent possible short circuits, use insulating couplings in the steam lines to and from the cleaner.

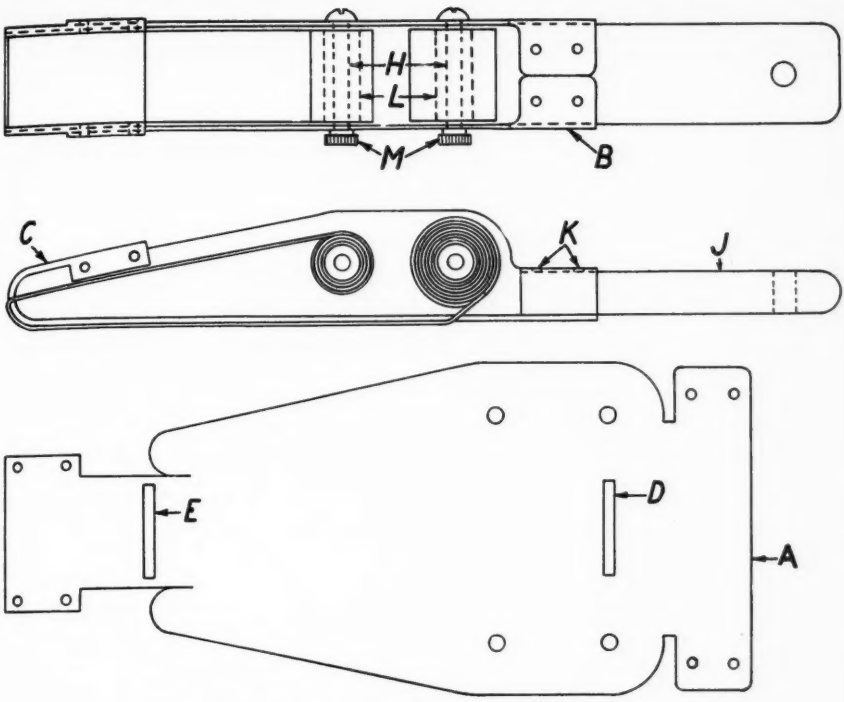
In small cleaner tanks it is possible to use a reversing switch making the work the cathode for several minutes; then throwing the switch and making the work the anode for several seconds to remove possible stain and to deplate any charged particles that may have been deposited. This procedure would not be practical for an automatic plating installation.

(Answered by Ezra A. Blount)

Refillable Buffing and Emery Sticks

A very handy device for the finishing department that can be used to easily perform a multitude of small, touch-up finishing operations is shown in the illustration herewith. The device consists primarily of an aluminum blank **A**, a wooden handle **K**, and two slotted wooden spools designated by **L**. To form the magazine of this device, the blank **A** is bent into the form shown at **B**. The handle **J** is inserted into the form **B** and is held in position by means of the indents made at **K**. The two wooden spools **L** rotate on the screws **H** and are held in place by the knurled nuts **M**.

The magazine of the device is loaded by winding a strip of buffing or emery cloth onto either of the wooden spools and then passing the loose end through either opening **D** or **E** depending upon the spool used. The loose end is then passed through the opposite slot (**D** or **E**) into the



Drawing Showing Design of a Refillable Buffing or Emery Stick

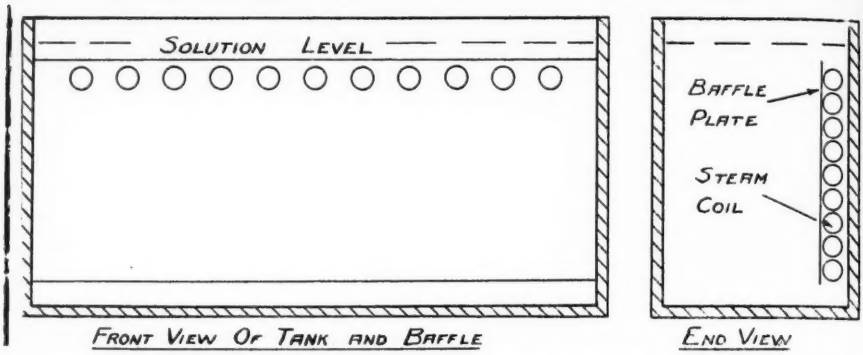
bottom of the magazine, at which point it can be wound onto the other spool. When the exposed section of the cloth is worn out, it can be replaced merely by winding the worn section around the one spool.

For convenience, the emery or buffing cloth should be purchased in rolled strips of the correct width.

Shield for Steam Coil in Alkaline Cleaning Tank

The shield or baffle plate shown in the accompanying illustration was developed to decrease the time required to heat an alkaline cleaning solution. The idea can be applied, of course, to any tank that must be heated to a certain temperature and maintained at that temperature.

The principle involved is simple. When the steam is turned on, the solution in the steam coil compartment is heated and forced out over the top of the baffle plate or through the holes cut along the upper part of the plate. More cold solution is then forced in at the bottom of the compartment and this is in turn heated quickly and forced out at the top, thus creating quite a rapid circulation of solution past the hot steam pipes. In this way there is cold solution always in contact with the hot steam pipes until the solution is heated to temperature, thus removing more heat from the steam per unit of time. The chemical engineering principle involved is that there is more heat



Drawing Showing Shield for Steam Coil in Alkaline Cleaning Tank

transferred between surfaces in motion for the same temperature difference.

ACT Bulletin G-14. In this bulletin now being issued by Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa., are described several time control devices which have been produced for non-standard applications. Each instance illustrated in the bulletin called for specialized design based on a careful study of requirements. Each had to provide a combination of dependability and accuracy. These cases of specialized timing are presented as definite advances in the art of automatic control. They are offered in the interest of discovering other situations in industry for which this company's engineers can produce operating improvements of a similar nature. Copy free upon request.

"Built To Endure." This is the title of a 16-page brochure devoted to a class presentation of Mercoid products which is now being issued by The Mercoid Corporation, 4213 Belmont Ave., Chicago, Illinois. Bound in spiral binding, this book illustrates and describes Mercoid controls that have been introduced with the development of automatic heat. Among the descriptions are those of the Sensatherms, thermostats, Pyratherms, line safety controls, limit and low water controls for steam boilers, temperature limit controls, warm air furnace controls and sealed mercury contact switches. Copy of this brochure free upon request.

Foxboro Bulletin No. 200-2. The Foxboro Company, Foxboro, Mass., has recently published a comprehensive 49-page bulletin on flow meters for steam, liquids, and gas. This bulletin is divided into four sections, as follows: 1. a broad survey of meter uses; 2. description of flow meters including the universal type, pressure compensating type for measuring flows where the static pressure is variable, combination meter with separate static and reverse control, dual-flow meters, bell type meters for low pressures, wide range meters, high pressure meters, and so on; 3. specifications and construction details; 4. charts, ranges, and paragraphs on primary devices, flanges, straightening vanes, pipe layouts and meter mountings. Copy free upon request.

Monel Wire Screen and Filter Cloth Bulletin H-3. This is the title of the 16-page bulletin now being issued by The International Nickel Company, Inc., 67 Wall St., New York, N. Y. Monel is said to be non-rusting. It is highly resistant to most corrosives and outstanding in contact with those most frequently met in practice such as brine, sulfuric acid solutions, and caustic alkalies. It has high rigidity and resistance to abrasion. It is readily applied, being well adapted to all fabricating operations, including resistance welding used in making pickling baskets, sieves, strainers, filter leaves, and so on. The bulletin also gives specifications and methods how to determine mesh and opening. Copy of Bulletin H-3 free upon request.

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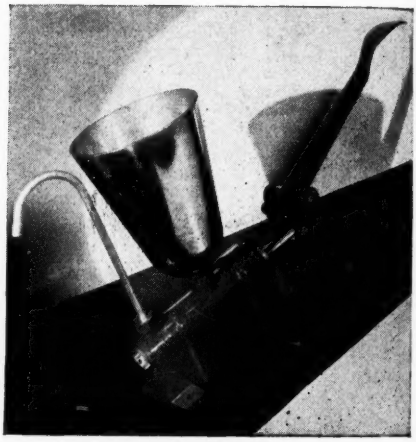
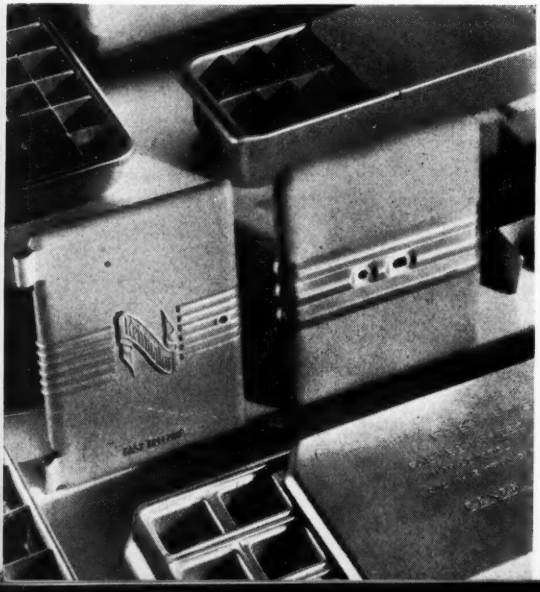


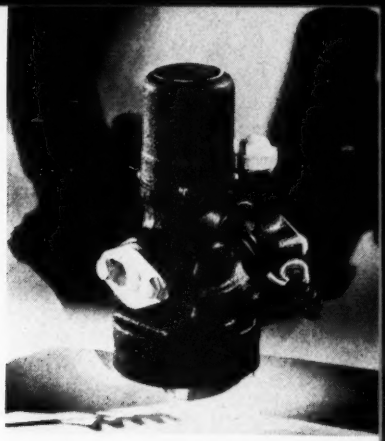
(Right)—A gray high-gloss enamel base forms a pleasing contrast with the high lustre polish on the milk-and-butter bowl of the Macreamer emulsifier shown herewith.

(Photo Courtesy of Parker-White Metal and Machine Co.)

(Photo Courtesy Aluminum Company of America)

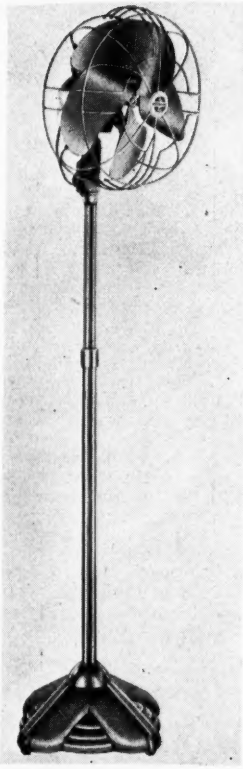


(Left)—The Alumilite process provides the surface of aluminum with a very thin but very durable coating. This coating has found particular favor in the refrigerator field where millions of ice cube trays and refrigerator doors are made of aluminum.



(Photo Courtesy of Sherwin-Williams)

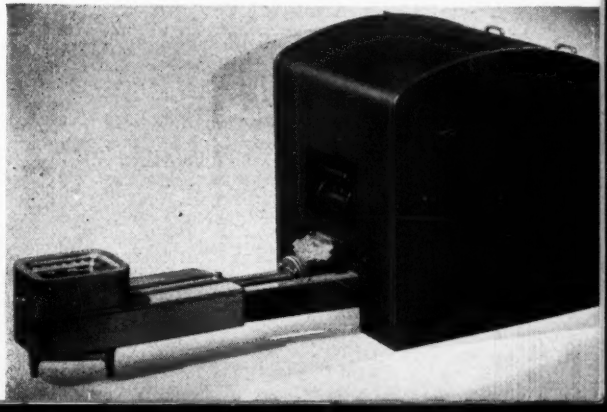
(Above)—The oil burner control unit shown herewith is a die casting finished in art metal finish. No undercoat is required and the finish covers in a single coating, being especially suitable for designs of this kind because the finish bakes to a perfect texture regardless of whether the surface is flat or curved, a bead, or a corner.



(Photo Courtesy of Westinghouse Electric and Manufacturing Co.)

(Left)—The pedestal type oscillating fan shown in the illustration is beautiful in appearance due to its rich, smooth, two-tone bronze finish.

(Photo Courtesy of Borg-Warner Corporation)



(Right)—Beauty is the keynote of this stoker. The crinkle enamel finish resists corrosion as well as abrasion.

NEWS *of the* INDUSTRY

Dust Control Equipment Manufacturers Completing Standards

Standards of dust control practice are rapidly nearing completion by the engineering committee of the Dust Control Equipment Association, according to announcement by Arthur J. Tuscany, executive secretary of the Association, whose offices are located in the Penton Building, Cleveland, Ohio.

At a number of meetings of the committee agreement has been reached on many questions which previously have been in doubt, thus clarifying relationship not only between purchaser and seller but between interests concerned with the dust hazard question.

The Dust Control Equipment Association has arranged for representation of their engineering committee on the American Foundrymen's Association Safety and Hygiene Committee and the Air Hygiene Foundation and request has been made for representation on the American Standards Association Committee Z-9, which committee is giving attention to the development of fundamentals relating to the design of exhaust systems.

Mr. Tuscany directs attention to the fact that neither the Dust Control Equipment Association nor its engineering committee propose to prepare codes, but it is further pointed out that the services, advice or assistance of the committee is available to any group which is interested in going into the dust control question.

Dr. Earl G. Sturdevant Appointed Consulting Engineer

United States Rubber Products, Inc., 1792 Broadway, New York, N. Y., has announced the appointment of Dr. Earl G. Sturdevant as consulting engineer of its electrical wire and cable department. Since 1920, when he took his doctorate at the University of Michigan, Dr. Sturdevant has been connected with many important scientific developments in the rubber field. After a two year interval of teaching at the University of Western Ontario, Dr. Sturdevant joined the technical staff of Western Electric. While there, he developed a method of continuous cure for rubber covered wires.

Dr. Sturdevant joined United States Rubber Products, Inc., in 1929, coming directly from Western Electric. In cooperation with the development staff at their general laboratories at Passaic, he had contributed in the work of commercially applying the process of the Hopkinson and Gibbons patent for forming a rubber thread directly from latex. This process is used in making the elastic core of "Lastex".

In 1931 Dr. Sturdevant was appointed development manager of the electrical wire and cable department where he contributed to the successful development of Laytex, the revolutionary new dielectric. In his new consulting capacity, he will apply his extensive technical knowledge to the perfection of United States Rubber's wire and cable products, and to the many developments in the rubber field to insulated wires and cables.

Carborundum Band To Appear at Great Lakes Exposition

The Carborundum Band of sixty members, under the direction of Edward D'Anna and which has been playing over the air waves for the past eleven seasons, has been invited to appear at the Great Lakes Exposition, Cleveland, Ohio. The celebrated band is scheduled to play two concerts on the afternoon and evening of July 24 which will be known as Carborundum Day at the Exposition. The concerts will be given in the mammoth band shell in what is known as Radio Land.

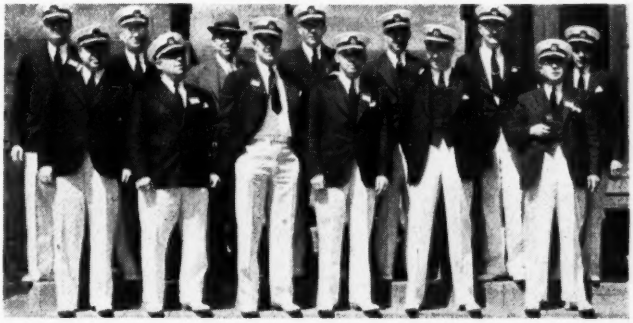
The appearance of the Carborundum Band at the Exposition will afford thousands who have heard this splendid organization on its radio programs, an opportunity of seeing as well as hearing one of the most outstanding musical units of its type in the country and one that has a great host of listeners in the fall and winter over the radio. The Carborundum Band is numbered among some 22 prominent radio features invited to appear in Radio Land at the Exposition.

The band will be accompanied by a group of officials of The Carborundum Company including Dr. Frank J. Tone, president; G. R. Rayner, vice president; F. H. Manley, treasurer; Charles Knupfer, general sales manager; Arthur Batts, secretary; department heads and other members.

S. S. Pangborn

One of the unusual and attractive exhibits shown at the recent American Foundrymen's Association Convention in Milwaukee was the S. S. Pangborn — the "ship of good will" which housed equipment and crew from the Pangborn Corporation, Hagerstown, Maryland. Occupying a large end aisle section of Mechanics Hall, the Pangborn exhibit was built to represent a ship's cabin and promenade deck connected to the main display section by a wooden gangplank. Steel rivets, large illuminated port holes, ship's bell, ship's lanterns swinging gaily beneath canvas deck awnings, life preservers and steamer chairs added to the illusion of the exhibit.

All Pangborn attendants were appropriately dressed to represent naval officers and their spick and span white trousers and shoes, dark coats, black ties and gold trimmed caps added the finishing touch to an already "see worthy" convention display.



A few of the crew that helped successfully sail the S. S. Pangborn on her maiden voyage. Reading from left to right, top row, are: A. L. Gardner, C. A. Bultman, E. O. Hamren, J. W. Speer, R. M. Trent, H. E. Schellhase, E. C. Gilmour; bottom row, F. E. Wolf, J. H. Connelly, R. E. Donnelly, B. R. Artz, W. O. Vedder and Victor F. Stine ("The Skipper").

Klinkenstein Discusses Spotting Out At Electro-Platers' Convention

"Spotting out", a defect that often appears on plated or oxidized products, was discussed by Gustave Klinkenstein of Maas & Waldstein Company, 438 Riverside Ave., Newark, N. J., at the annual convention of the American Electro-Platers' Society held in New York City. Mr. Klinkenstein pointed out that there are two kinds of spotting out. The first of these, called "crystal spotting", occurs only on "oxidized" products; that is to say, products of brass copper, silver, nickel, and other metals (either solid or plated) with the surface darkened by treatment with sulphide solutions. The other kind of spotting is called "stain spotting", and this trouble occurs chiefly on plated products.

Crystal spots form on oxidized products after they have been lacquered. They are usually small, dark in color, and obviously crystalline when viewed under a lens. They are due to the action of sulphur on the metallic sulphide coating of the product. This sulphur may come from furnace gases in the atmosphere, from the wrappings of the products, and other sources. Crystal spotting is minimized by using sulphur-free wrappings and by protecting the products from atmospheric sulphur by using lacquers specially developed for this purpose.

Stain spotting is caused by traces of salts from the plating bath (chiefly the cyanides), which remain in the pores of the metal coating. These residual salts can not be completely removed by rinsing, and, unless their action is neutralized in some way, they will absorb moisture, overflow of the pores, and form blotches on the surface of the product.

To reduce stain spotting, the following precautions were recommended: (a) use compact base metal; (b) keep free

cyanide in bath low; (c) thorough rinsing; (d) allow products to stand over night in humid atmosphere after plating and remove stains next day; (e) bake products at 250 deg. F., which inactivates the salts; (f) use "non-stain-spot" lacquers.

Norton Company Announce Expansion

The Norton Company, Barber's Crossing, Worcester, Mass., has announced the completion of plans for the construction of a new building to be located in Worcester, Massachusetts. The building will be occupied by the grinding wheel finishing departments and will be ready for use about November 1. It will be 300 ft. long and 100 ft. wide, and the architectural design will be the Aiken transverse monitor type, providing for admission of light from overhead.

Dr. G. E. Landt Appointed Technical Director of Continental-Diamond Fibre Company

The Continental-Diamond Fibre Co., Newark, Delaware, has announced the promotion of Dr. G. E. Landt from chief chemist to technical director. This promotion followed the resignation of general manager Mr. L. W. Tarr, placing Dr. G. E. Landt in full charge of all technical problems.

Dr. G. E. Landt

American Electroplaters' Society Silver Jubilee Convention Declared Complete Success

Monday, June 14, 1937, marked the opening of the most successful annual convention ever to be held by the American Electroplaters' Society. At 9 o'clock on that memorable day, more than 200 delegates assembled in the Grand Ballroom of the Hotel Pennsylvania, New York City, to hear addresses by Frank J. Liguori, president of the New York Branch, Mr. Moss of the Mayor's office, Charles H. Proctor, founder of the AES, and E. Steen Thompson, President of the Society. F. J. MacStoker, General Chairman, introduced Mr. Moss, who spoke on behalf of Mayor LaGuardia.

The first educational session of the convention was presided over by George G. Hogaboom, first president of the AES. Interesting papers were read by Dr. Blum, on the progress of exposure tests and laboratory tests of plating on non-ferrous metals, and the use of color photography in the inspection of exposure tests of plating. Mr. A. Brenner explained a magnetic method for measuring the thickness of nickel castings on non-ferrous metals. During the course of his paper, Mr. Brenner gave a demonstration in which he determined the thickness of several nickel deposits.

During a luncheon given by the International Fellowship Club on Monday, Mr. Paul Savage of the McGean Chemical Company, was elected president. Mr. Oliver Sizelove, Frederick Gumm Chemical Company, was elected vice-president of the club.

The events of the first day were "topped off" at the annual Open House of the International Fellowship Club held in the Grand Ballroom of the Hotel Pennsylvania. An estimated group of 700 persons attended the affair which marked the first official gathering of a purely social nature in connection with the convention.

On Tuesday morning, a guided sightseeing tour of the city in deluxe motor coaches was conducted. For Tuesday afternoon, the Program Committee arranged for an inspection tour of the S. S. Normandie, the fastest of the transatlantic liners. The Tuesday evening educational session was presided over by W. S. Barrows, third President of the AES.

Two full-length educational sessions, a tour of the famous Radio City, and a trip to the Bell Laboratories to view the exposure tests being made by the U. S. Bureau of Standards comprised the list of events for Wednesday. Mr. John E. Sterling, New York Branch, presided over the morning educational session and Horace Smith, Newark Branch, presided over the evening session.

The record-breaking Silver Jubilee Convention concluded its activities on Thursday with an educational meeting in the morning, a business session in the afternoon, and the annual banquet and dance which was held in the Grand Ball Room in the evening. Mr. Oscar Servis, Chicago Branch, presided over the final educational session. At the business session, the National officers were elected as follows: Mr. A. Wilson, President; Mr. F. J. MacStoker, First Vice President; Mr. R. Goodsell, Second Vice President, and Mr. A. Fletcher, Third Vice President. Milwaukee, Wisconsin, was selected as the meeting place of the Annual Convention in 1938 and Asbury Park for the Annual Convention in 1939.

N. A. Strand & Company Announce Agency

N. A. Strand & Company, 5001 N. Lincoln St., Chicago, Ill., manufacturers of flexible shafts and machines, have recently made exclusive agency arrangements in Canada with Williams & Wilson, Ltd., covering the Provinces of Quebec, Ontario, and the Maritime Provinces. A substantial stock of machines and equipment will be carried both at Montreal and Toronto.

Designers for Industry, Inc., Establish Quarters in New York

Designers for Industry, Inc., Cleveland, Ohio, industrial designers and product stylists, have established quarters in the International Bldg., Rockefeller Center, New York. A designing staff will be maintained in the New York office which is in charge of Mr. H. C. Gooding who was transferred from the Chicago office to become business manager for the Eastern district.

Ed Ristau Appointed Vice President of Skilsaw, Inc.

An announcement has been made recently relative to the promotion of Ed Ristau, advertising manager, to the position of vice president of Skilsaw, Inc., 3310 Elston Ave., Chicago, Illinois. Mr. Ristau is a capable person and is well acquainted with the duties of his new office.

Ed Ristau, newly appointed vice president of Skilsaw, Inc.

Laboratory Trailer Speeds Color Matching in Porcelain Enameling Industry

A laboratory on wheels that will visit every porcelain enamel plant east of the Mississippi is being sent on its planned route by B. F. Drankenfeld & Company, Inc., 49 Park Place, New York, N. Y. Aboard the trailer are color oxides and all of the equipment needed to turn out fired color samples. It contains spray booth, furnace, large and small grinding mills, balances, testing equipment, a complete assortment of base oxides, and so on.

The trained color experts in charge are qualified to perform the entire process from weighing out ingredients to the final firing, and all in air conditioned comfort. The use of the service of the trailer by manufacturers in the porcelain enamel industry will greatly speed the matching of colors for all types of ware.

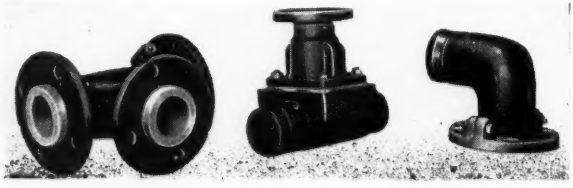
New Plant Equipment and Materials

Haveg Standard Pipe and Fittings, Valves, and Fume Ducts

Corrosion resistant pipe and pipe fittings, valves, and fume ducts made of Haveg are being marketed by Haveg Corporation, Newark, Delaware. Haveg "41" pipe and fittings are molded from a mixture of a special acid-washed asbestos and a synthetic phenolformaldehyde resin. This composition is said to have strength, toughness, and durability, together with corrosion resistance which is not a surface condition, but which exists throughout the mass of the material. The Haveg material is exceptionally resistant to almost all acids with the exception of oxidizing acids like nitric, to chlorine, to the weaker bases and to many solvents and other chemicals.

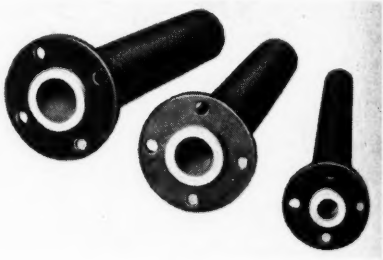
Haveg pipe and fume ducts are not affected by rapid temperature changes and can be used continuously at temperatures as high as 265 deg. F. without damage. Because of its low thermal conductivity, it is normally unnecessary to insulate Haveg lines. Haveg "41" pipe and fittings for handling liquids are supplied in standard sizes from ½ in. to 12 inches. Fume duct is made in sizes from 2 in. to 30 inches. Nonstandard sizes and special modifications are also available.

Haveg is said to be unaffected by hydrochloric acid in all concentrations and at all temperatures up to the maximum of 265 deg. F. Specific applications include absorption towers, storage tanks, fume systems, pipe lines, valves, muriatic acid pickling tanks, and so on.



Haveg Standard Fittings and Valves

Up to a concentration of 50 per cent, Haveg can be used at boiling temperatures with sulphuric acid. Besides the many chemical applications which this resistance permits, a substantial use of Haveg with sulphuric acid is said to exist in pickling tanks for the steel industry.



Haveg Corrosion Resistant Pipe

Haveg is said to be uninjured by chlorine, wet or dry, with or without hydrochloric acid present. As a result, it has been used successfully in cells, chlorine lines and wherever resistance to chlorine is a major factor.

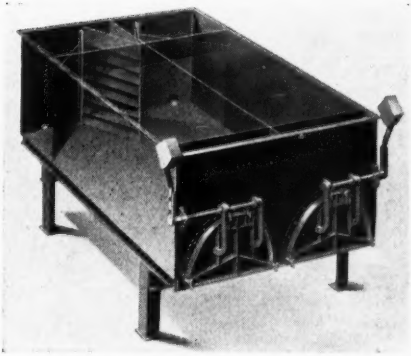
Schneible Dewatering Tank

A Rectangular Tank Multi-Louver Dewaterer for use in small systems of multi-wash dust collectors where the quantity of water and sludge produced does not justify the use of a large capacity truck type dewatering tank, or a still larger concrete rectangular tank has been brought out by The Claude B. Schneible Co., 3951 Lawrence Ave., Chicago, Ill. As the name implies, the unit is rectangular in shape and, made for setting directly on the floor or on steel legs as

the conditions require. The tank is made with a divider down the center separating it into twin tanks for alternate use. At the opposite end are located the weir, skimmer walls, multi-louvers, and recirculating and dewatering outlets. The design is said to be simple and foolproof. There are no moving parts thus there is practically no wear.

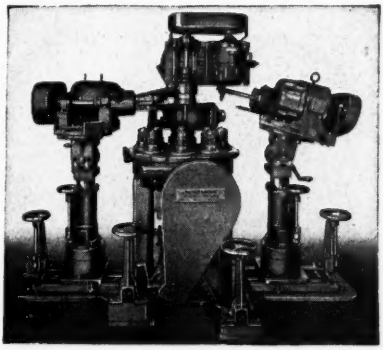
Sludge and water from the multi-wash collector is piped to the dewatering tank and enters at the closed end through the inlet distributor trough which directs it into one of the sections of the tank. The manufacturer states that as the sludge and water flow into the tank, precipitation of solids immediately takes place, the skimmer wall holding back floating material as the clear water flows over the weir from where it is pumped back for re-use for dust collection.

The low velocity of the water in the tank allows for complete precipitation of the solids in the area around the multi-louver vanes. When one of the tanks is sufficiently filled with precipitated material, the inflow water is switched to the other section of the tank by means of the inlet distributor trough allowing for an additional precipitation period.



Schneible Dewatering Tank

After complete settling, the valve on the line leading to the interior of the loaded tank is opened and the head of water in the tank is allowed to recede slowly. The water flows out of the precipitated material and does not



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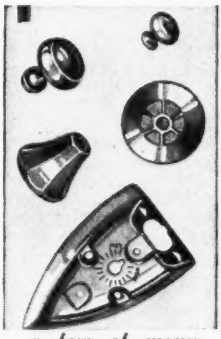
The Packer Machine Co.
Meriden, Conn.



a few of many

PACKER
Automatic
POLISHING & BUFFING MACHINES

carry the material with it due to the angle of repose of the silicate sludge against the multi-louver vanes.

The final draining period reduces the moisture contained in the sludge down to approximately 20 per cent or lower. Then the sludge in the dewatered tank is completely drained, the discharge gates are opened and the sludge is pushed out into a convenient receptacle for disposal.

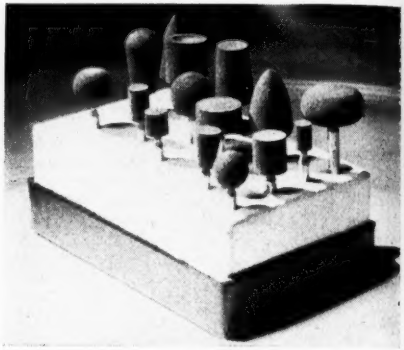
This new rectangular type of dewatering tank provides for easy clean-out by means of the large counterbalanced clean-out doors which, when closed, are sealed against watertight gaskets. The top of the tank is open to allow for ready inspection and measurement of the solids content of the tank in operation.

"Chicago" Soft Rubber Polishing Wheels

A new type of polishing wheel in which an extremely soft rubber bond having a high degree of ductility and flexibility is impregnated with five different types of polishing compound, to be known as the "Chicago" Soft Rubber Polishing Wheel, has been placed on the market by Chicago Wheel & Manufacturing Co., 1101 W. Monroe St., Chicago, Ill. The wheel is intended for removing finish grind marks and is said to produce a high and brilliant finish on any metal surface.

The wheel can be run either wet or dry on practically any standard equipment and may be dressed with an ordinary diamond or grinding wheel dresser to any desired contour. Due to the type of bond used, the contour will be maintained over a long period of time without the necessity of further dressing.

The cutting action of the wheel can be varied in keeping with the requirements of the job upon which it is used. The polishing action is always evident, however, regardless of the cutting action of the wheel, due to the fact that the



"Chicago" Soft Rubber Polishing Wheels

bond itself is a burnishing agent and is in a large part responsible for the efficiency of the results. The high polish is obtained without chatter.

The wheel is ideally adapted for portable equipment of all types having speeds that would give the wheel a surface speed not in excess of 4000 s.f.m. One of the features of the wheel is that high speeds are not required for its application. Surface speeds lower than 4000 s.f.m will give perfectly efficient results.

A sample of the "Chicago"' Soft Rubber Polishing Wheel will be sent to any reader of this magazine upon request.

Hancock Bronze Valves

The Hancock Valve Division of the Consolidated Ashcroft Hancock Co., Inc., Bridgeport, Conn., has added 1¼-in., 1½-in. and 2-in. sizes in globe and angle patterns to their line of bronze valves. These valves are provided with exceptionally hard stainless stell seats and discs.

The trim in the Hancock Valves is heat treated to a hardness of 500 Brinell and then machined on a diamond boring machine. The manufacturer states that this remarkable hardness enables the valves to smash or cut paper clips, nails, pipe turnings, boiler scale, and sand without leaving a trace of a mark on either the valve seats or discs.

The illustration shows a steel nail which the manufacturer states was crushed between the seat and disc of the 2-in. valve, also shown in the illustration. It is also stated that this unusual hardness provides the valves with added resistance to wire drawing and steam cutting, thus lowering maintenance costs.

Hancock 2-In. Bronze Valve

Udylite Gloves, Boots, and Aprons for Electroplaters

For protecting the electroplater at work, The Udylite Company, 1651 E. Grand Blvd., Detroit, Mich., has placed on the market a line of rubber gloves, boots and aprons. The gloves are available in two colors, namely red and white. The red is said to wear and resist acids very well. The gloves are reversible and can be used for either right or left hands. The white gloves are also highly resistant to acids and corrosive liquids. They are reinforced at the wearing points, thus insuring long life.

Heavy weight rubber aprons and light weight rubber aprons are available. The heavy weight is 32 in. by 45 in. and weighs 3 pounds. They are made of one-ply heavy sheeting and high grade acid resistant stock on both sides. All edges are turned in and reinforced with extra ply rubber. The light weight aprons weigh approximately 2½ pounds.

White, red-white sole, black-red sole are the three types of rubber boots available. The sizes range from 7 to 12 with no intermediate sizes. Each type is said to be very highly wear and acid resistant.

Bristol Portable Pyrometer

A millivoltmeter-type Portable Indicating Pyrometer is now being offered by The Bristol Company, Waterbury, Conn., for measuring temperatures up to 3000 deg. F., using a thermocouple and extension leads.

Use of a cobalt magnet allows exceptional design features, including increased sensitivity and a widened scale for more accurate readings. Unusual sensitivity is accomplished without the need for critical leveling adjustments and with no sacrifice of ruggedness. The high-resistance millivoltmeter movement is double-pivoted and completely shielded to prevent the effects of stray fields.

The molded Bakelite case is of moisture and dust-proof construction, and of modern design. The instrument is

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Bristol Portable Pyrometer

available in single and in double ranges. It is especially adapted for industrial use.

U. S. Permobond

Corrosive-proof protective linings which are now available for practically every kind of service and known as "Permobond" have been brought out by the United States Rubber Products, Inc., 1790 Broadway, New York, N. Y. Permobond has, through the extensive advance made in the compounding and the perfecting of the bonding of rubber-to-metal process, reached a high point as a lining material. Maximum resistance to corrosion, diffusion, abrasion, and electrical conductivity is said to be provided with Permobond. For storage equipment, Permobond is said to insure freedom from mechanical difficulties, better uniformity of product, and freedom from contamination of product.

The success of Permobond linings is based on three principles: one, compounding the rubber to meet the specific problem of the job; two, the permanent bonding to the walls of the tank; and three, the fact that Permobond linings are tailor-made. The result is a job especially engineered to fit individual requirements plus a permanent leak-proof lining and a bond that is practically an integral part of the metal surface itself.

The best example of Permobond's use in connection with inorganic acids is as a lining in pickling and processing tanks, storage tanks, pipe and pipe fittings, and tank cars. It finds its most extensive use with organic acids in process storage equipment for handling tartaric acid.

Ferric chloride, an inorganic salt used by modern sanitary engineers to coagulate sewage before disposal, is extremely corrosive to metals, yet inactive on rubber. Permobond lined equipment can be used for the transportation and storage of the ferric chloride solution.

Permobond linings find greatest application in plating tanks. They are said to save floors from acid leakage, lower operating and maintenance costs, and contribute materially to product uniformity. Linings are available in tanks for full automatic, semi-automatic and batch plating.

Bleaching solutions and chlorine water solutions used in municipal water sanitation are said to be handled inexpensively, satisfactorily, and without corrosion in tanks lined with Permobond.

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ALL TYPES FOR ALL KINDS OF METALS . . FURNISH POSITIVE PROTECTION . . TO SUIT YOUR PARTICULAR REQUIREMENTS, AIR DRIED OR BAKED. WRITE FOR INFORMATION.

ROWE PAINT CO.
Long Island City, N. Y.

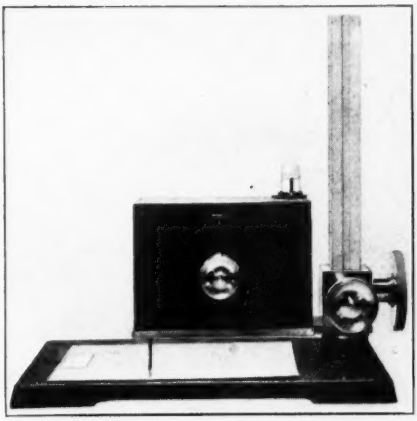
American Instrument for Measuring the Thickness of Nickel Coatings on Non-Magnetic Base Metals

The local thickness of an electroplated nickel coating on a non-magnetic base metal can be measured by an instrument which has been brought out by the American Instrument Company, Inc., 8010 Georgia Ave., Silver Spring, Md. The principle of the method is said to involve the measurement of the force required to detach one pole of a permanent magnet from the nickel coating, and the comparison of this force

with that required to detach the same magnet from a similar nickel coating of known thickness.

The instrument is calibrated with nickel coatings of known thickness which have been deposited under about the same conditions as the coatings to be tested. Nickel coatings deposited under different conditions have somewhat different magnetic permeabilities, but if such coatings are annealed at 400 deg. C. (750 deg. F.) they acquire about the same permeability and therefore the magnetic method is more reliable for annealed coatings than for coatings as deposited. Measurements on coatings as deposited are said to be correct within 15 per cent, and on annealed coatings within 10 per cent.

The magnetic method is rapid and non-destructive, and for thin coatings its accuracy approaches that of metallographic measurements. The sensitivity of the American instrument can be varied by the proper selection of the spring, each division on the dial corresponding to approximately 0.00025 mm. (0.00001 in.) of nickel, so that the 100 divisions cover the range of thickness usually applied to non-ferrous metals. The reproducibility is about 3 per cent on coatings down to about 0.0005 mm. (0.00002 in.), The instrument is equally applicable to plane, convex and concave surfaces. The presence of the usual thin chromium coatings over the



American Instrument for Measuring Nickel Coatings on Non-Magnetic Base Metals

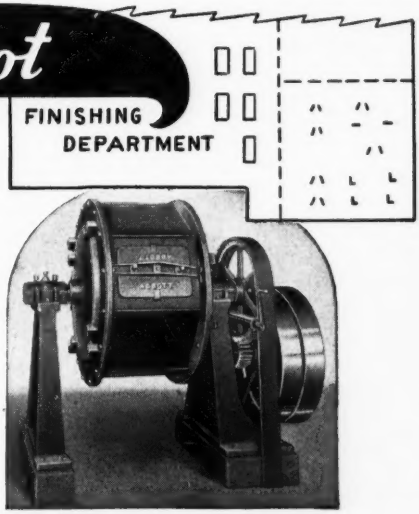
Here's the Spot

for extra profits

Enjoy low cost finishing on small metal parts. Abbott Burnishing Barrels do the job in double quick time by directing weight on the work in process.

Send a few unfinished samples and put it up to our experimental department to show you what can be done. We'll give complete details and quote on barrels and materials.

The Abbott Ball Company
1060 New Britain Avenue
Hartford, Connecticut



ABBOTT BALL BURNISHING

nickel is said to have no appreciable effect on the thickness measurements, and as advantageous because it prevents oxidation of the nickel during annealing.

The instrument is compact and light in weight, measures 5x9x9, and weighs 7½ lbs. without carrying case.

G. M. No. 5 Spray Gun

A spray gun for pressure tank use with an ingenious nozzle that completes atomization at the nozzle has been brought out by the G. M. Manufacturing Co., 218 N. Clinton St., Chicago, Illinois. The gun, to be known as the "G. M. No. 5 Spray Gun", is said

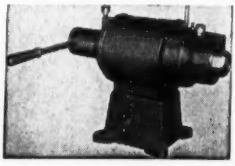
G. M. No. 5 Spray Gun

to eliminate at least 25 per cent mist thereby resulting in a great saving of paint and other finishing materials. The nozzle is unusual in shape and size, with air ports spaced so that there is said to be practically no expansion before air touches the material. All the power of expansion is applied to the complete atomization of the paint. This results in savings of about 25 per cent in material cost for finishing jobs.

The No. 5 Spray Gun is made of simple but finely machined parts. It is built especially for use on pressure material containers, or paint pressure lines requiring 20 to 30 lbs. material pressure and 60 to 80 lbs. air pressure. It is recommended for spraying lacquers, enamels, oil paints, varnishes, cold water paints, calmines, and so on.

The double breakage and the fine atomization are said to eliminate orange peel because the operator is able to apply a much wetter coat of material.

IDEAL SPEED LATHES



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SMALL PARTS

2 Speed Motor. Automatic Brake. Collet or 3 Jaw Chucks. Hand operated or automatic. Write for Cir. 351.

SCHAUER MACHINE CO.
903 Broadway Cincinnati, Ohio

Drying Metal In a Vacuum

A flash method of drying metal articles without oxidation has been developed by the F. J. Stokes Machine Co., 5930 Tabor Rd., Olney P. O., Philadelphia, Pennsylvania. The material to be dried is placed in a special vacuum chamber from which oxygen, together with the inner constituents of the air, have been removed. The materials are then heated and this heat stored in the metal is utilized rapidly to remove the residual moisture from all surfaces and all crevices. This method of drying has been used successfully to dry copper wire which has been "bright annealed" and then pickled and washed. The wire can be dried thoroughly without oxidation before going to the enameling machine where even the thinnest oxide scale would prevent proper adherence of the enamel.

Drying in a vacuum can be supplied in the thorough drying of all parts of electrical circuit breakers including places which are inaccessible to mechanical removal of moisture. Drying of the parts in this instance is said to prevent staining or corrosion of the metal caused by plating chemicals spotting out while the breaker is in use or in the stockroom. Such staining or corrosion frequently necessitates replating and reassembling of the parts before the breakers can be shipped. This same method of drying can be used for vacuum rinsing of the breakers, thus insuring more complete removal of the plating chemicals before drying takes place.

Bercolene

An aluminum mixing vehicle to be known as "Bercolene" has been brought out by the North Bergen Varnish Corp., 1001 39th St., North Bergen, N. J. This vehicle is said to keep the aluminum powder in suspension long enough for it to flow out to an even leaf, and the result is smooth, silvery appearance.

Bercolene can be used in the propor-

tion of 5 gallons to 7½ lbs. of aluminum powder for a very bright coating. The powder should first be wetted with a solvent and stirred thoroughly until it becomes a silver paste. The balance of the vehicle is added until the mixture is at the right consistency for coating machines. Coated sheets should be baked at 385 deg. F. to 400 deg. F. for 30 minutes. It is stated that the coating does not crack under bending and will withstand fabrication. It can be used to good advantage on caps, crowns, cans, and all aluminum decorative work.

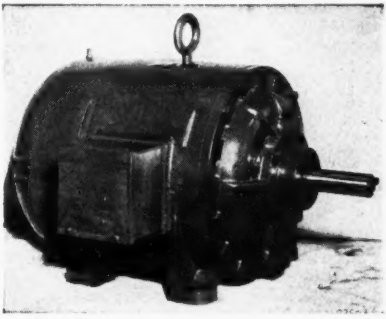
Westinghouse Type CS Dual Ventilated Fan-Cooled Squirrel Cage Motors

A dual ventilated fan-cooled squirrel cage motor which is protected against abrasive dust, moisture and corrosion, has been announced by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The motor, to be known as the Type CS, has been designed especially for use in automobile factories, foundries, cement plants, coal tipples, machine shops, steel mills, chemical plants, dye houses, tanneries, packing plants, and so on, where severe service is required. The motors may also be installed outdoors without additional protection.

The motor frame contains two separate sets of air ducts, one set internal and one set external. The internal ducts are open in the interior part of the motor and the external ducts are open on the outside of the motor frame. The two sets of ducts are separated by a common wall.

The heat exchanger principle is employed for cooling. An internal fan on the rotor circulates warm internal air through the internal ducts, the walls of which are cooled by the external fan blowing larger volumes of cool air through the external ducts, providing rapid transfer of heat from the motor and thus insuring long insulation life.

The housing is designed so that fresh grease enters the outside edge at the top of the bearing and excess or used grease is discharged at the bottom inner edge to the overflow sump. Since adding fresh grease automatically cleans the used grease from the bearing, it is unnecessary to incur the expense of periodically dismantling the motor to clean the bearings. The used or excess grease may be readily removed from the overflow sump through a pipe plug opening. The cartridge-type bearings are fully protected when the rotor is removed.



Westinghouse Type CS Dual Ventilated Fan-Cooled Squirrel Cage Motor

Diacetone Solvent

A solvent has been developed by the Commercial Solvents Corp., Terre Haute, Ind., and is to be known as

CUT REJECTS *on Highly Polished Surfaces*

Write for a **FREE SAMPLE** *of Protex*

USE PROTEX

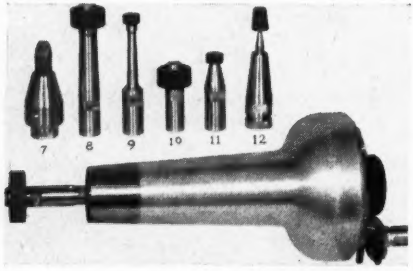
Get your product to your customer without scratches and resultant discoloration. Protex is easily applied. It peels off in a hurry. Cut rejects!

HAYDN F. WHITE & CO.
1740 E. 12th St., CLEVELAND, OHIO

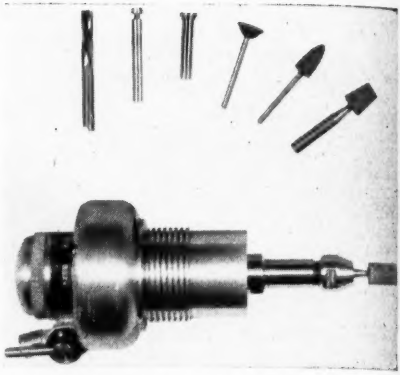
"Diacetone." This solvent is recommended for cellulose acetate, nitrocellulose, resins and gums, and most of the alkyd resins. It is said to be miscible with any of the common oils such as castor, linseed, and so on. It is also completely miscible with water and all common organic liquids. It is available in two grades, technical and acetone free. The technical grade contains not over 16 per cent acetone.

Onsrud Model E-1 and Model MD-1 Air Turbine Grinders

The line of air turbine grinders made by the Onsrud Machine Works, Inc., 3916 Palmer St., Chicago, Ill., has been augmented by the addition of the Models MD-1 and E-1, illustrated herewith. The Model E-1 Grinder developed ½ h.p. and 38,000 r.p.m. on 90 to 100 lb. of air pressure, and is designed for the grinding of forgings, large dies, and similar work. As can be noted from the illustration, the shape of the tool is such that it easily fits the operator's hand. It is of sturdy construction. The housing is of duro-aluminum, the spindle is of nickel steel, heat treated and ground, and the rotor is of aluminum bronze.



Onsrud Model E-1 Air Turbine Grinder



Onsrud Model MD-1 Air Turbine Grinder

The Model MD-1 has been on the market, but has been redesigned to obtain the "stream-line" effect and to eliminate sharp corners. This tool will also now fit into the operator's hand, as shown. This tool develops ¼ h.p. and 50,000 r.p.m. on 90 to 100 lbs. of air. It has the same construction and is of the same material as the Model E-1.

An outstanding feature of the tools is the lubricating system, which is of the centrifugal force type. The spindle is filled with fine oil, and centrifugal action feeds this oil through resistance elements to the precision ball bearings in a film, thus insuring adequate and proper lubrication when the tool is running and none when it is idle; thus there is no danger of overheating as a result of over-lubrication. As in all Onsrud air-driven tools, the bearings are kept cool by expanded exhaust air.

Bristol Anticipating Device For Pyrometer Controllers

The Bristol Company, Waterbury, Conn., has perfected a device known as the B-Linator for use with automatic pyrometer controllers such as are used on industrial heating furnaces. The purpose of this device is to enable the pyrometer controller to anticipate temperature changes and correct the fuel consumption long enough in advance to prevent the temperature from cycling or rising above and falling below the control point as it does because of the ther-

G-M
SPRAY GUN
For pressure tank use . . . Patented nozzle reduces spray mist 25% . . . Saves paint . . . Gives a full, wet coverage . . . From 1/8" stripe to 14" fan spray.
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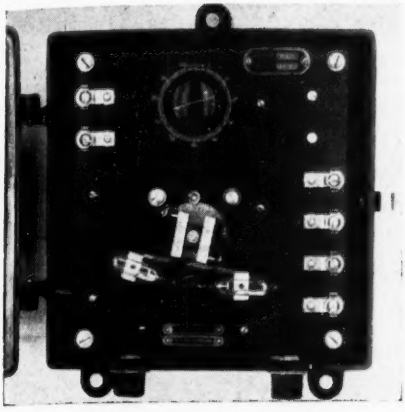

Bristol Anticipating Device for Pyrometer Controllers

mal inertia offered by the mass of the furnace and the load.

The B-Linator can be used with practically all of the commonly used types of pyrometer controllers and can be added to present installations as well as incorporated in the control circuit of new equipment. It has the ability to anticipate temperature change trends, and thus enables the control equipment to smooth out the usual wavy control record to a straight line.

The B-Linator through a switching device adds or subtracts an emf to the regular thermocouple circuit to cause the controller to act in anticipation of a temperature change. The auxiliary emf is derived from thermocouples in the B-Linator case connected in series but opposing each other. The magnitude of the emf produced by these thermocouples is dependent on the temperature change trends. The varying emf produced by the B-Linator annexes the anticipating feature of the control apparatus, enabling it to maintain a close temperature in the furnace.

Optimeter for Measuring of Electroplates

An optimeter for measuring the thickness of electroplates is being manufactured by Carl Zeiss, Inc., and distributed by the George Scherr Co., Inc., 128 Lafayette St., New York, N. Y. The optimeter serves for the rapid high precision checking of the length, thickness or diameter of work of practically every shape in the shop, inspection room, or laboratory. The instrument itself consists of a telescope bearing an ocular with a glass scale laterally behind it at one end, and a horizontally pivoted mirror resting on an axially movable contact plunger at the other end. In looking through the ocular, the eye perceives a stationary index mark superimposed upon the reflected image of the scale. Any movement of the contact plunger tilts the mirror, thereby producing an apparent shift of the scale image by the product of the movement of the beam of light, times the magnification of the scale by the lens system, an amount which in the instrument is equal to about 1000. The scale is subdivided into 0.00005 as the smallest interval. The instrument is suitable for measuring thickness of electrodeposited coatings as thin as chromium.

Superior Ventilated Storage Rack

Superior Wire and Iron Products, 1055 E. 76th St., Chicago, have developed a storage rack which is claimed to have several distinct advantages.

Heavy wire mesh so woven to expose an absolute flush working surface for

FLEXEMENT

Flexible Polishing Wheel Cement

Makes Wheels Cut 3 to 5 Times Longer!

FLEXEMENT is quickly and easily applied and produces a flexible head that cuts faster and longer—Can be forced dried—Eliminates glue pots, cooking, air conditioned wheel rooms, etc.—Users report savings up to 60% over old methods.

FLEXEMENT is available in 3 types for grains up to No. 300. Shipped in 50 lb. and 750 lb. containers. **Order today.**

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Everything for Polishing and Plating

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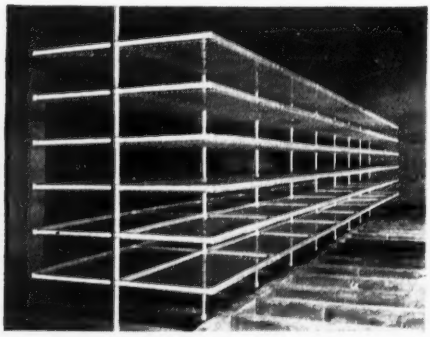
Detroit, Mich.

stock handling ease, gives complete ventilation, prevents warping or moisture accumulation, allows no dust or dirt accumulation, allows maximum sprinkler system operation and permits the filtering of light through complete structure for better working conditions. Shelves are adjustable to any position without trouble, allowing complete flexibility of equipment for changing stock requirements and permits a more compact stock arrangement. Center post construction allows access to material from any direction without hindrance. But to fit any material handling requirements, Superior Ventilated Racks may be obtained in any size and are standard equipped for stationary, portable or mono-rail installation.



Superior Ventilated Storage Rack

Houghton's Acitrol 100

A pickling inhibitor which is said to be efficient at all ranges and over a long period of time, to be known as "Acitrol 100," has been brought out by E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. Acitrol 100 is said to be based on the acknowledged principle of setting up an electrolytic insulating film where steel is attempting to dissolve, yet at the same time having no retarding effect on the solution of scale. It exerts an electrolysis control which differentiates between the productive and non-productive galvanic couples present in pickling solution.

Acitrol 100 is a synthetically manufactured, pure chemical powder inhibitor which dissolves readily in either strong or weak acid solutions and leaves no greasy residue or stain on the steel. It shows practically no breakdown at boiling temperature over long periods of time. While all pickling is not done at high temperatures, a breakdown around boiling point does show what is occurring to a lesser extent at moderate temperatures.

Acitrol 100 will resist heat and time exposures and is a chemically pure product, leaving the steel with a clear, bright finish.

WIDE WET SPRAY

Milburn paint spray guns deliver a wide wet spray which speeds the job and produces a better finish.

WRITE FOR NEW CATALOG

THE ALEXANDER MILBURN CO.
1436 W. Baltimore Street
Baltimore, Maryland

Lea pH Papers

The Lea Mfg. Co., 14 Cherry St., Waterbury, Conn., has placed on the market a method for the determination of pH by the use of pH papers, which permit visual quantitative determination of the acid or alkaline content of solutions. They are said to be as fast as the well-known Litmus papers and give accurate quantitative results at a glance. The following ranges are available: 5.2 to 6.7, 3.6 to 5.0, 3.7 to 5.3, 1.2 to 3.4, 0.9 to 1.5, 9.5 to 11.0, 11.0 to 13.5.

These papers are said to be very handy not only in the laboratory but out in the plant where control of acidity or alkalinity in production must be maintained.

White Synthetic Enamels

The laboratories of The Gilbert Spruance Company, Richmond & Tioga Sts., Philadelphia, Pa., have recently developed a line of white synthetic enamels formulated to meet specific requirements, such as low bake and high bake. The enamels may be sprayed, dipped or brushed, depending on the formula. It is claimed that this line of enamels is characterized by exceptional flexibility, adhesion, durability and toughness.

There is no after-baking discoloration with these enamels and they are said to produce an intense full-bodied, white film in one coat. Although the enamels were formulated for use on metal, they may also be used on wood. According

to the manufacturer, these non-poisonous synthetic enamels are particularly well suited for use in the finishing of refrigerators, hospital equipment, novelties, and juvenile furniture.

Oxidizing Barrel

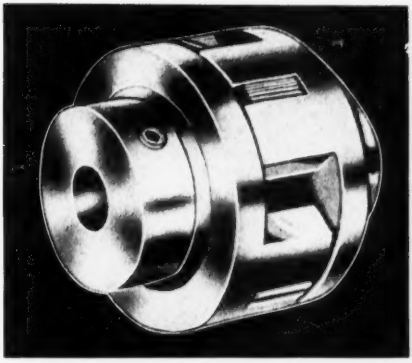
Plating Products Company, 350 Mulberry St., Newark, N. J., have placed on the market a portable oxidizing barrel for handling small parts such as nuts, bolts, washers, and stampings on a production basis. It is stated by the manufacturer that this barrel can be used with almost any of the well-known processes of rust-proofing or black finishing by immersion.

The barrel is of all welded construction and is equipped with a worm drive gear reduction and a clutch. It is also equipped with adjustable arms so that it may be suspended from the top of the solution tanks. It is possible to rotate the barrel inside or out of the solution. The barrel is available in several sizes and specified perforations.

Waldron Fractional Horse Power Flexible Coupling

A new Francke All-Steel Fractional Horse Power Flexible Coupling has been added to the line of Francke couplings built by the John Waldron Corporation, New Brunswick, N. J.

This coupling is recommended for fans, fuel pumps, generators, etc. up to ¾ h.p. at 1800 r.p.m. and for shafts up to ¾ in. diameter. It provides free and independent lateral floating of the connected shafts, accurate alignment surfaces, an assembled one-piece all-steel center member, large load carrying surfaces, is torsionally resilient, mechanically flexible and silent at any speed. It is fully described in Francke Bulletin No. 53, a copy of which will be sent to any reader upon request.



Waldron Fractional Horse Power Flexible Coupling

I-R ¼ H.P. Air Compressor

Ingersoll-Rand Company, Phillipsburg, N. J., has announced a new line of fractional horsepower air compressors in ¼ and ½ horsepower sizes. These units are very compact and neat in appearance. They have automatic start and stop control, are equipped with a new style seamless steel tank, and an improved check valve.

When furnished for single phase current they are equipped with a brushless capacitor type motor and a built-in automatic protection switch giving overload and under-voltage protection. They are rated for 150 pounds per sq. in. maximum pressure, but may be set for lower pressures, or may be equipped with a reducing valve for still lower pressures.

The ¼ and ½ horsepower units are

HENDERSON-TUMBLING BARRELS

The No. 5A Tilting Oblique Machine shown at the right gives you the utmost in safe and economical tumbling —safety foot lever . . . perfect leverage . . . minimum vibration.

Since 1880 Designers and Builders of All Types of Tumbling Equipment.

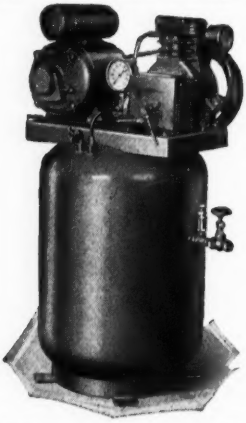
Write for Bulletin.

THE HENDERSON BROS. CO.

131 LEONARD ST., WATERBURY, CONN.

"The Tumbling Barrel People"

available on a 2.4 cu. ft. tank, which is illustrated. This unit is less than 35



Ingersoll-Rand ¼ H. P. Single-Stage Air Compressor

inches high. The ½ horsepower size is also available on a 4.6 cu. ft. tank.

Alum Cote and Gold Coat

Two coatings for application on sheet steel or tin, known as "Alum Cote" and "Gold Coat," have been placed on the market by The Watson-Standard Co., 225 Galveston Ave., Pittsburgh, Pennsylvania. These coatings are said to have a remarkable resemblance to actual aluminum and gold metal. The most outstanding feature of these coatings is the ability to take extremely deep draws.

One coat application, either roller coated or sprayed, is said to give complete coverage, brilliant lustre, and an economical finish.

MASKALACO
A MASKING PASTE

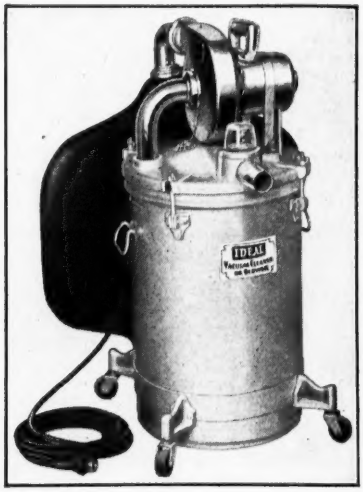
For use in multicolor lacquering, painting, enameling, screen processing, etc. Striping and decorating more effective — less costly — with Maskalaco. Write for full details and sample.

CLEAVELAND
LABORATORIES & MFG. CO., INC.
447 Wilson Ave., Newark, N. J.

Ideal "Tank Type" Industrial Cleaner

An industrial cleaner which vacuums, blows, and sprays, to be known as the Ideal "Tank Type" Industrial Cleaner, has been brought out by the Ideal Commutator Dresser Co., 1221 Park Ave., Sycamore, Illinois.

The Tank Type is said to pick up heavy pieces of metal scrap, shavings, grindings, metal dust, pieces of wood or other materials, and deposits them in the tank where their weight is balanced between ball bearing casters for easy portability. When used as a blower, the Tank Type delivers a forceful blast



Ideal "Tank Type" Industrial Cleaner

of dried air at 24,200 ft. per minute. It is readily adapted to spraying paint, varnish, oil and so on. It is light to handle and has the power and stability for heavy work. Standard equipment includes 11 attachments. There are 67 special attachments available for specific problems.

The entire standard unit weighs about 40 pounds. The aluminum finished steel tank has a capacity of 12 gallons. The motor is of universal type, 110, 220, or 250 volts, 25 to 60 cycles.

Super Thermo Stucco

A refractory stucco, to be known as "Super Thermo Stucco," has been de-

veloped by Chicago Fire Brick Co., 1465 Elston Ave., Chicago, Ill. This material is an air or heat-setting, high fusion, strong bonding coating-mix which can be troweled or sprayed in thick coatings over any fire clay refractory surface, hot or cold, old or new, porous or glazed. Under firing it becomes an integral part of such refractory. It is recommended as an effective way to build up and restore almost any area of wall that has been burned away, spalled off or otherwise erroded in varnish and annealing furnaces. Super Thermo Stucco is packed moist at a very thick consistency and comes ready for trowel use as delivered.

New Red Giant Hydraulic Liftruck

To handle weights greater than are ordinarily assigned to single and double stroke trucks, and to elevate more than 2½ in., Revolvator Co., North Bergen, N. J., has brought out the new Red Giant Hydraulic Liftruck shown in the illustration. This truck is designed to life loads of from 2500 to 10,000 lbs.—and heavier if necessary.

The advantages claimed for this truck are made possible by the hydraulic system. The load may be elevated by long or short strokes at the will of the operator, the effort being equal from any angle around the circle.

An automatic shut off is provided to operate when the platform reaches the full height. The load is released by means of an automatic foot lever, which is adjustable. A telescoping frame is used which gives the maximum of clearance underneath and provides the maximum of strength with the minimum of weight. The hydraulic system is oil-tight and leak-proof. The handle is spring balanced, the springs being enclosed in an oil chamber. A free pull on the handle is available at any height of the lift. The handle is positive but non-kicking, operating on roller bearing

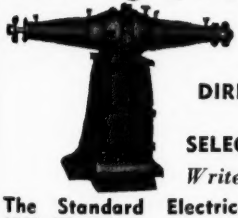
New Red Giant Hydraulic Liftruck

pivots. The large turntable makes for effortless steering, due to the ball and roller precision bearings.

Wrinkadur

A special finish to be known as "Wrinkadur" has been brought out by the H. V. Walker Co., Elizabeth, N. J. It is said to have a very fine wrinkle which is uniform even when used on a rough or irregular metal surface. Good coverage, easy spraying, and durability are obtainable with Wrinkadur. The adhesion and toughness of this finish make it adaptable for articles that are subject to wear or considerable handling.

Buffing & Polishing Lathes



½ H.P. TO 20 H.P.

DIRECT DRIVEN and SELECTIVE SPEED

Write for Catalog

The Standard Electrical Tool Co.
1941 W. 8th St. Cincinnati, Ohio

McAleer

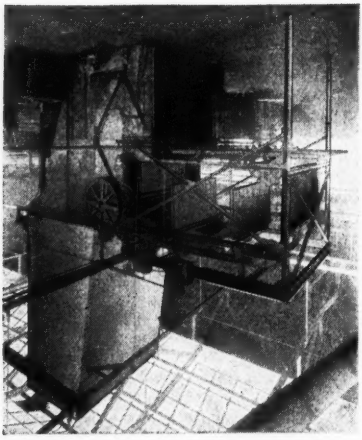
● The extensive McALEER line of buffing compositions and lacquer rubbing compounds is well recognized for its quality, economy, and uniformity.

For complete details write to McALEER—the headquarters for dependable polishing and buffing supplies.

McALEER MANUFACTURING CO.
2431 SCOTTEN AVE.
DETROIT, MICHIGAN

Kirk & Blum Industrial Ovens

Ovens which are said to reduce costs, improve the appearance of the product and speed up production are now being



A typical K & B engineered industrial oven installation.

offered to the trade by The Kirk & Blum Manufacturing Co., 2816 Spring Grove Ave., Cincinnati, Ohio. Accurate engineering information pertaining to oven equipment for all purposes has been compiled by the Kirk & Blum Mfg. Co. through years of experience. This vast amount of engineering information enables Kirk & Blum engineers to quickly and intelligently analyze problems and to submit recommendations, specifications and prices. This excellent engineering service does not entail any obligation.

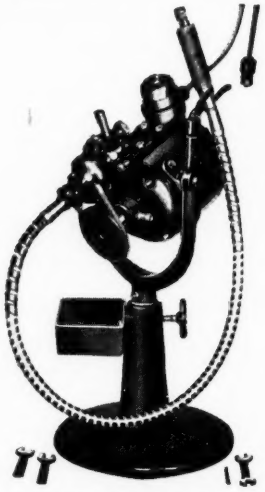
BEAUTIFUL FINISHES
Get Plated, Polished, and Satin effects with our special shaded Gold and Aluminum Bronze Powders. Send for Samples and Color Card.
EDWARD C. BALLOU CO.
259 W. 14th STREET NEW YORK

Collord Anode Scrap Saver

Scrap anodes in the plating room may be entirely used up with the "Scrap Saver" which has been placed on the market by Collord, Inc., 7049 Lyndon St., Detroit, Michigan. The basket is heavily insulated with a semi-hard rubber and is designed to carry heavy loads. The Scrap Saver is available in sizes most suitable for use in a given plating tank. In use, the unit is hung on the bus-bar with a good anode at the center. Around this anode is placed the scrap material that is to be used.

Strand Type MY-4 Flexible Shaft Machine

The line of flexible shaft equipment manufactured by N. A. Strand & Co., 5001 N. Wolcott Ave., Chicago, Ill., has been augmented by the addition of the



Strand Type MY-4 Flexible Shaft Machine

Type MY-4 Flexible Shaft Machine shown in the illustration. The machine is powered by a ¼ h.p. capacity motor and has a three-speed ball bearing countershaft. The belt is guarded. The motor is mounted in a swiveling yoke, permitting the machine to swivel in all directions. Two combinations of speeds are available: 1700, 3000 and 4200 r.p.m., and one with high speeds of 3400, 6000 and 10,400 r.p.m.

The machine is equipped with a 4-ft. flexible shaft with a ball bearing hand

piece fitted with a split collet. The tool box is attached to the bench stand, which is provided with an adjusting stud for raising or lowering the machine to the desired height. The manufac-

turer has designed a small ball bearing right angle attachment, interchangeable with this machine, as illustrated herewith, arranged with split collet for holding tools with round shanks.

Lewis-Shepard Lift Trucks and Lift Truck Platforms. A new, small, colored folder—No. 322—describing and illustrating the lift trucks and lift truck platforms made by Lewis-Shepard Company, 267 Walnut St. Watertown, Boston, Mass., is now being distributed by that company. The folder points out the features of the skid platforms, such as the one-piece steel frame, arc welded construction, solid steel supports, smooth flush wood tops, steel binding all around, absence of bolt holes to split boards, floating platform boards, double strength side girders, and so on. Copy free upon request.

Effect of Wheel Speed on Polishing Performance. This publication, No. 2 of Volume 28 of "Grits and Grinds", is devoted to a discussion of the most efficient speeds at which to operate the modern high speed grinding wheels. The text comprises practically a report of the conclusions which have been arrived at after a considerable amount of research and experimentation both in the laboratories of the Norton Company and other places. A chart shows the total cost per unit of metal removed with the wheels operating at various speeds from 4500 to 9000 r.p.m. Results of tests made for machine vibration at various speeds are also included. One page comprises a table of disc wheel recommendations in which the proper wheels are suggested for a wide variety of work on materials of various kinds including aluminum, brass, bronze carbon, cast iron, steel forgings, dies, porcelain, rails, springs, and so on.

Illustrations include views taken from the polishing departments of various industries, general view of Norton Company Research Laboratories, special equipment used in making tests, drying ovens used in the research laboratory, different types of wheels mounted for operation, and so on. Copy free by addressing Norton Company, Worcester, Massachusetts.

Roxalin Chip Proof Colored Flexible Lacquer Enamel. A product summary giving the properties of this cellulose type, air-drying, flexible lacquer enamel is now being issued by Roxalin Flexible Lacquer Co., Inc., Box 775, Elizabeth, N. J. This type of finish is available in all colors—standard or special match. It does not chip, flake or peel and stands blanking and forming. Several samples on brass, aluminum and cold rolled steel are supplied for test by scratching, bending, and so on. Copy free upon request.

Check in DeWITT OPERATED HOTELS
Genuinely Friendly
In CLEVELAND it's
√ The HOLLENDEN
In COLUMBUS it's
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In TOLEDO it's
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